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NATIONAL DAM INSPECTION PROGRAM. BLUE HEAD DAM (NDS ID NUMBER P--ETC(U)
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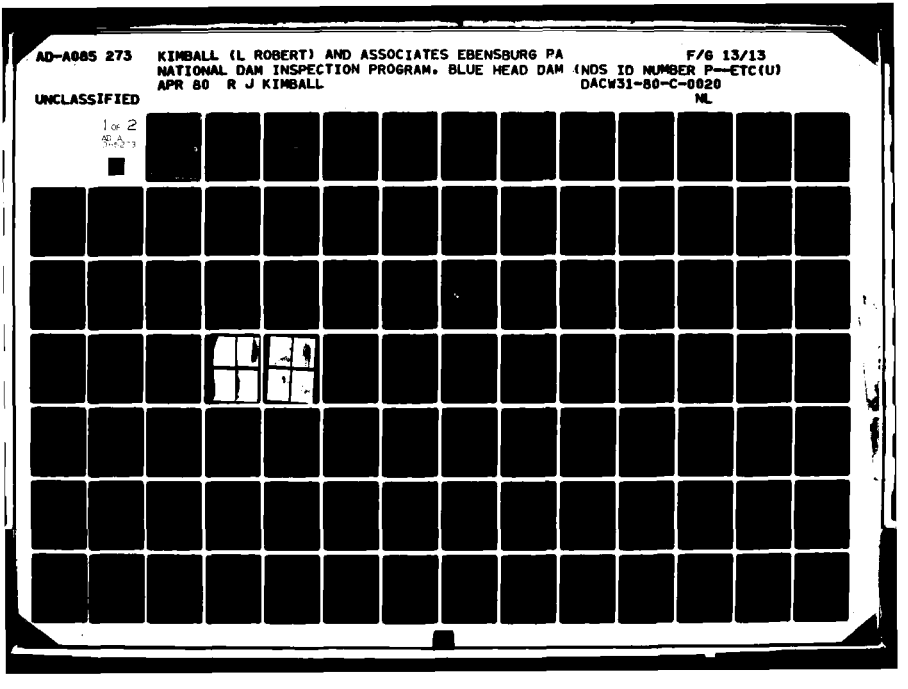

SUSQUEHANNA RIVER BASIN

NEGRO HOLLOW AND MESSER RUNS, SCHUYLKILL COUNTY

PENNSYLVANIA

BLUE HEAD DAM

NDS ID NO. PA-678

DER ID NO. 54-37

MAHANOY TOWNSHIP MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

APRIL, 1980

L. ROBERT KIMBALL & ASSOCIATES

DACW31-80-C-0020

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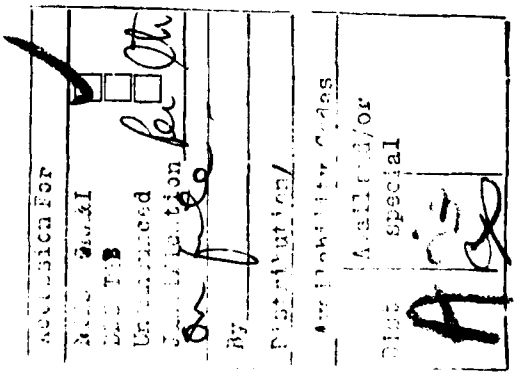
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Blue Head Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Schuylkill
STREAM	Negro Hollow and Messer Runs
DATE OF INSPECTION	November 7 and 16, 1979

ASSESSMENT

The assessment of Blue Head Dam is based upon visual observations made at the time of inspection, review of available records and data, hydraulic and hydrologic computations and past operational performance.

Blue Head Dam appears to be in fair condition. The erosion on the crest and upper portions of the slopes should be repaired. In addition, the wet areas and seepage areas should be monitored on a regular basis. Maintenance of the dam and operating facilities is considered poor. Blue Head Dam is a high hazard-small size dam. The recommended Spillway Design Flood (SDF) for this dam is the 1/2 PMF to PMF. Based on the potential for downstream loss of life, the SDF has been selected as the PMF. The spillway and reservoir are capable of controlling approximately 25% of the PMF without overtoppping the embankment. Based on criteria established by the Corps of Engineers, the spillway is termed seriously inadequate. If Blue Head Dam should fail due to overtopping, the hazard to loss of life and property immediately downstream of the dam would be significantly increased from that which would exist prior to the overtopping. Blue Head Dam is classified as unsafe non-emergency.

The following recommendations and remedial measures should be instituted immediately.

1. A detailed hydrologic and hydraulic study should be conducted by a professional engineer knowledgeable in dam design to develop plans to increase spillway capacity. This study should begin immediately and remedial modifications begun immediately after this study is complete. The spillway exit channel should be evaluated to determine whether improvements are required.

2. The seepage and wet areas located on the downstream slope and at the toe of the embankment should be monitored at regular intervals and during periods of heavy precipitation and evaluated by a professional engineer experienced in dam design and analyses.

3. The leaking outlet works valves should be repaired. The valves should be operated and lubricated at regular intervals.

4. Some means of upstream positive closure of the drainlines should be developed in case of emergencies.

5. The brush and trees should be cleared from the slopes and removed from the spillway exit channel at the direction of a professional engineer knowledgeable in the design and construction of dams.

6. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

7. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

8. The catch basin located in the pumping basin should be repaired.

9. The erosion of the crest and the upper portions of the slopes should be repaired.

SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

April 11, 1980

Date

R. Jeffrey Kimball

R. Jeffrey Kimball, P.E.

APPROVED BY:

16 May 1980

Date

James W. Peck

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

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APPENDICES

PHASE I
NATIONAL DAM INSPECTION PROGRAM
BLUE HEAD DAM
NDI. I.D. NO. PA 678
DER I.D. NO. 54-37

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Blue Head Dam is an earthfill dam, 1250 feet long and 34 feet high. The crest width of the dam is 10 feet. Both the upstream slope and downstream slopes are 1.5H:1V. The upstream slope is protected with hand placed conglomerate boulders.

The spillway is located on the right abutment and consists of an ogee shaped concrete weir with a crest length of 86 feet. The spillway exit channel is formed by concrete retaining walls with a paved bottom.

Water is discharged from the reservoir through two 10 inch cast iron pipes controlled by gate valves located at the toe of dam. Originally these gate valves were operated by long stems extending up the slope of the embankment to the top of dam. These stems are no longer in existence. Water can be discharged through these outlet pipes and into a pumping basin located immediately at the toe of dam. From this pumping basin water can be pumped out of the watershed through a 14 inch main into the Cold Run Reservoirs, and then distributed to Mahanoy City and vicinity.

Lofty Reservoir, with a storage capacity of approximately 90 millions gallons, a drainage area of 1.5 square miles and a flooded area of about 30 acres, is located on Messer Run approximately 3 miles upstream from Blue Head Dam.

b. Location. The dam is located at the junction of Negro Hollow and Messer Run, approximately 5 miles northeast of Mahanoy City, Schuylkill County, Pennsylvania. Blue Head Dam can be located on the Delano, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Blue Head Dam is a small size dam (34 feet high, 160 acre-feet).

d. Hazard Classification. Blue Head Dam is a high hazard dam. Downstream conditions indicate that loss of more than a few lives is probable should the structure fail. Immediately downstream of the dam are two occupied dwellings.

e. Ownership. Blue Head Dam is owned by Mahanoy Township Authority. Correspondence should be addressed to:

Mr. George Palmer, Manager
Mahanoy Township Authority
46 North Main Street
Mahanoy City, PA 17948
(717) 773-0650

f. Purpose of Dam. Blue Head Dam was formerly used for water supply. The dam is currently inactive. The dam has not been used for water supply for approximately 12 years.

g. Design and Construction History. Very little information is available on the design and construction history of the dam. The dam was built in 1884 under the personal direction of Mr. Mark D. Bowman, engineer for the Mahanoy City Water Company. No additional information is available on the original design and construction history. The spillway was reconstructed in the period of 1916 to 1917. The spillway was again rebuilt in 1936.

h. Normal Operating Procedures. The reservoir is not currently used for water supply. No operations have been conducted at the dam for approximately 12 years. When the reservoir was in use the outlet works through the dam were opened to allow water to enter into the pumping basin located at the toe of dam. From this pumping basin water was pumped to Mahanoy City.

1.3 Pertinent Data.

a. Drainage Area. 5.68 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Drainline capacity at normal pool	Unknown
Spillway capacity at top of dam	2385

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on pool elevation 1128.0 interpolated from U.S.G.S. 7.5 minute quadrangle.

Top of dam - low point	1131.7
Top of dam - design height	Unknown
Normal pool	1127.8
Spillway crest	1127.8
Streambed at centerline of dam	1098.0
Maximum tailwater	None
Toe of dam	1098.0

d. Reservoir (feet).

Length of maximum pool	900'
Length of normal pool	700'

e. Storage (acre-feet).

Normal pool	98
Top of dam	160

f. Reservoir Surface (acres).

Top of dam	17.3
Normal pool	14.7
Spillway crest	14.7

g. Dam.

Type	Earth embankment
Length	1275'
Height	34'
Top width	10'
Side slopes - upstream	1.5H:1V
- downstream	1.5H:1V
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Reservoir Drain.

Type	Two 10" CIP's
Length	Approximately 90'
Closure	Valve at toe
Access	Valve at toe
Regulating facilities	Valve at toe

i. Spillway.

Type	Ogee
Length	86'
Crest elevation	1127.8'
Upstream channel	Lake
Downstream channel	Messers Run

SECTION 2
ENGINEERING DATA

2.1 Design. The owner did not provide any design data. The Commonwealth of Pennsylvania, Department of Environmental Resources supplied some backup data pertaining to general statistics of the dam, several drawings on repairs made to the spillway, photographs, permits, and correspondence for this structure. All this information was reviewed to complete this report.

2.2 Construction. No information exists on construction of the dam.

2.3 Operation. No operating records are maintained.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER, Bureau of Dams and Waterways Management and through interviews with the owner. The manager of the Municipal Authority was interviewed to obtain data of operation and maintenance of the dam.

b. Adequacy. Detailed analyses cannot be made because of the lack of detailed design information. This Phase I report is based upon available data, visual inspection, and a hydrologic and hydraulic analyses.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Blue Head Dam was conducted by personnel of L. Robert Kimball and Associates on November 7 and 16, 1979. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in fair condition. From a brief survey conducted during the inspection, it was noted that a low spot exists near the left abutment. In general, the crest of the dam slopes from a low spot near the left abutment to a high point on the right abutment. Both the upstream and downstream slopes were measured to be 1.5H:1V. The upstream slope is protected with conglomerate riprap. The lower portion of the downstream slope, near the pumping basin, is also protected with riprap. The remaining portion of the downstream slope is covered with weeds and high grass. Several large trees are growing at the immediate toe and at several places along the dam. The crest width was measured to be 10 feet and is concave in shape. Some erosion is taking place along the crest and upper portions of the downstream and upstream slopes. Several wet areas were noted along the toe of the dam. One of these wet areas is located near the left abutment at the toe of dam and is created by poor surface drainage. Another wet area is located to the right of the pumping basin near the toe of dam. No flow was noted from these wet areas. Seepage estimated at one to two gallons per minute is located on the downstream slope to the left of outlet works valves.

Downstream of the dam in the pumping basin is a catch basin which is in need of repair. This catch basin drains the pumping basin.

c. Appurtenant Structures. The spillway is located at the right abutment and consists of a concrete ogee shaped weir. The weir appeared to be in good condition. The wingwalls constructed at either side of the concrete weir need minor repairs. The concrete floor in the spillway exit channel is heaving in several places and needs to be repaired. One tree is growing in the spillway exit channel and should be removed. At the immediate end of the spillway exit channel, erosion is beginning to undercut the channel.

The two 10 inch cast iron outlet works pipes were not operated during the inspection. A minor amount of seepage was occuring through these pipes during the inspection. No upstream closure is provided on these pipes.

d. Reservoir Area. The watershed is covered mostly with woodland. The reservoir slopes are moderately steep but do not appear to be susceptible to landslides which would affect the storage volume of the reservoir or overtoppping of the dam by displacing water.

e. Downstream Channel. Messers Run downstream of Blue Head Dam is moderately wide, for approximately 3500 feet until it meets Catawissa Creek. Catawissa Creek is windy but has a moderately wide flood plain.

3.2 Evaluation. In general, the embankment and appurtenant structures appear to be in fair condition but poorly maintained.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at the spillway crest elevation 1127.8. The outlet works have not been operated for approximately 12 years. The excess inflow discharges over the spillway crest. The resevoir has not been used for water supply for approximately 12 years.

4.2 Maintenance of the Dam. No planned maintenance schedule exists. Maintenance of the dam is performed by the Water Authority staff. Maintenance of the dam is considered poor.

4.3 Maintenance of Operating Facilities. Maintenance of the spillway and outlet works is considered poor. The valves on the outlet works should be operated and lubricated at regular intervals. The undercutting and minor erosion of the spillway channel need to be repaired.

4.4 Warning System in Effect. There is no warning system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam and operating facilities is considered poor. There is no system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. No calculations or design data pertaining to hydrology or hydraulics were available.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the recent past. The spillway was rebuilt in 1917 and 1936.

c. Visual Observations. The spillway appeared to be in good condition with the exception of the undercutting at the end of the spillway exit channel. The outlet works pipes are leaking and have not been operated recently.

A low spot was noted on the dam embankment near the left abutment.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. Pool elevation in the reservoir prior to the storm is at the spillway crest elevation 1127.8.

2. The top of dam was considered the low spot at elevation 1131.7.

3. The SDF was routed through the upstream reservoir, Lofty Dam. This dam was inspected by others during the Phase I inspection program for the Baltimore District, U.S. Army Corps of Engineers. All data pertaining to Lofty Dam was obtained from this report.

4. For the dam breach analysis it was assumed that the dam would fail when the water level in the Blue Head Dam reached elevation 1132.8 or 1.1 feet over the top of dam. Lofty Dam was assumed to have breached and the flood wave was incorporated into the inflow associated with the Blue Head breach model.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	11659 cfs
Spillway capacity	2385 cfs

a. Spillway Adequacy Rating. The SDF is based on the hazard and size classification of the dam. The recommended Spillway Design Flood (SDF) for this dam is the 1/2 PMF to PMF. Based on the potential loss of life, the SDF has been selected as the PMF. Based on the following definition provided by the Corps of Engineers, the spillway is rated as seriously inadequate as a result of our hydrologic analysis.

> Seriously inadequate - High hazard classification dams not capable of passing 50% of the SDF and where there is a significant increase in the hazard potential for loss of life downstream due to overtopping failure.

The spillway and reservoir are capable of controlling approximately 25% of the PMF without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam cannot satisfactorily pass 50% of the PMF (based on our analysis) it was necessary to perform the dam breach analysis and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure.

The results of the dam breach analysis indicates that the downstream potential for loss of life and property damage is significantly increased by dam failure. The two dwellings located at the toe of dam would not be affected by discharges through the spillway. However, should the structure fail these dwellings would be in imminent danger. Therefore, the spillway is rated as seriously inadequate. Further downstream, flooding may not be significantly increased due to failure of the dam. Details of the downstream routing of the flood wave are included in Appendix D.

Note: Future development within the watershed, at the dam, or downstream may change the characteristics and assumptions made for this study and different results are likely. Future development downstream may also be increased potential for loss of life due to failure of the structure.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The crest of the dam is rounded and shows some signs of erosion. Little vegetation exists on the crest to help control this erosion.

Two wet areas were located during the inspection near the toe of dam. These wet areas are located near the left abutment and to the right of the pumping basin near the toe of dam. In addition, seepage estimated at one to two gallons per minute was observed to the left of the outlet works valves on the downstream slope. (See page A-12). These wet areas and seepage areas should be monitored at regular intervals and after periods of heavy precipitation.

b. Design and Construction Data. No stability analyses are on record for this dam. No data on the design or construction is available.

c. Operating Records. No operating records are maintained.

d. Post Construction Changes. No post construction changes are known other than reconstruction of the spillway.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in fair condition. A small amount of seepage on the downstream slope and several wet areas at the toe of dam were in evidence during the inspection. Some erosion of the crest and extreme upper portions of the upstream and downstream slopes is taking place. No stability analyses has been performed on the dam. The visual observations, review of available information, hyrologic and hydraulic calculations indicate that Blue Head Dam's spillway is seriously inadequate. The spillway is capable of controlling approximately 25% of the PMF without overtopping the embankment. The hydrologic analyses indicates that the flooding downstream of the dam would be significantly increased due to failure of the dam from that which would exist prior to dam failure. Blue Head Dam is classified as unsafe non-emergency.

b. Adequacy of Information. Detailed analyses cannot be made because of the lack of any design or construction data. This Phase I report is based on visual observation, review of available data, hydrologic and hydraulic calculations and past operations and performance.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required by a professional engineer knowledgeable in dam design and analysis.

7.2 Recommendations/Remedial Measures.

1. A detailed hydrologic and hydraulic study should be conducted by a professional engineer knowledgeable in dam design to develop plans to increase spillway capacity. This study should begin immediately and remedial modifications begun immediately after this study is complete. The spillway exit channel should be evaluated to determine whether improvements are required.

2. The seepage and wet areas located on the downstream slope and at the toe of the embankment should be monitored at regular intervals and during periods of heavy precipitation and evaluated by a professional engineer experienced in dam design and analyses.

3. The leaking outlet works valves should be repaired. The valves should be operated and lubricated at regular intervals.

4. Some means of upstream positive closure of the drainlines should be developed in a case of emergencies.

5. The brush and trees should be cleared from the slopes and removed from the spillway exit channel at the direction of a professional engineer knowledgeable in the design and construction of dams.

6. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

7. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

8. The catch basin located in the pumping basin should be repaired.

9. The erosion of the crest and the upper portions of the slopes should be repaired.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Blue Head Dam COUNTY Schuylkill STATE Pennsylvania ID# PA 678

TYPE OF DAM Earthfill HAZARD CATEGORY High

DATE(s) INSPECTION November 7 and 16, 1979 WEATHER Cloudy, warm TEMPERATURE 50°

POOL ELEVATION AT TIME OF INSPECTION 1128.0 M.S.L. TAILWATER AT TIME OF INSPECTION 1097.8 M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

James T. Hockensmith RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Crest of dam and upper portions of downstream slope shows some erosion. The crest is concave in shape. No vegetation exists on the crest of the dam.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment appears to be good. A bend exists in the crest near the left abutment See page A-12. Low spot on the crest near the left abutment.	
RIPRAP FAILURES	Riprap needs to be repaired in several locations.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Vegetation on slopes near the left abutment. Several large trees at the toe of dam and several locations.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be good.	
ANY NOTICEABLE SEEPAGE	Several wet areas at the toe of dam - See page A-12. Seepage estimated at one to two gallons per minute was noted to the left of the outlet works valves on the downstream slope.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet works only observed at the downstream toe.	
INTAKE STRUCTURE	Unobserved during inspection.	
OUTLET STRUCTURE	None.	
OUTLET CHANNEL	None.	
EMERGENCY GATE	Valve on outlet works at toe of dam.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete appears to be in good condition. Wingwalls need some minor repairs.	
APPROACH CHANNEL	Lake.	
DISCHARGE CHANNEL	Concrete lined chute with concrete retaining walls. Floor of exit channel is heaving and needs repairing. One large tree in exit channel. End of exit channel shows erosion and undercutting. This needs to be repaired.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

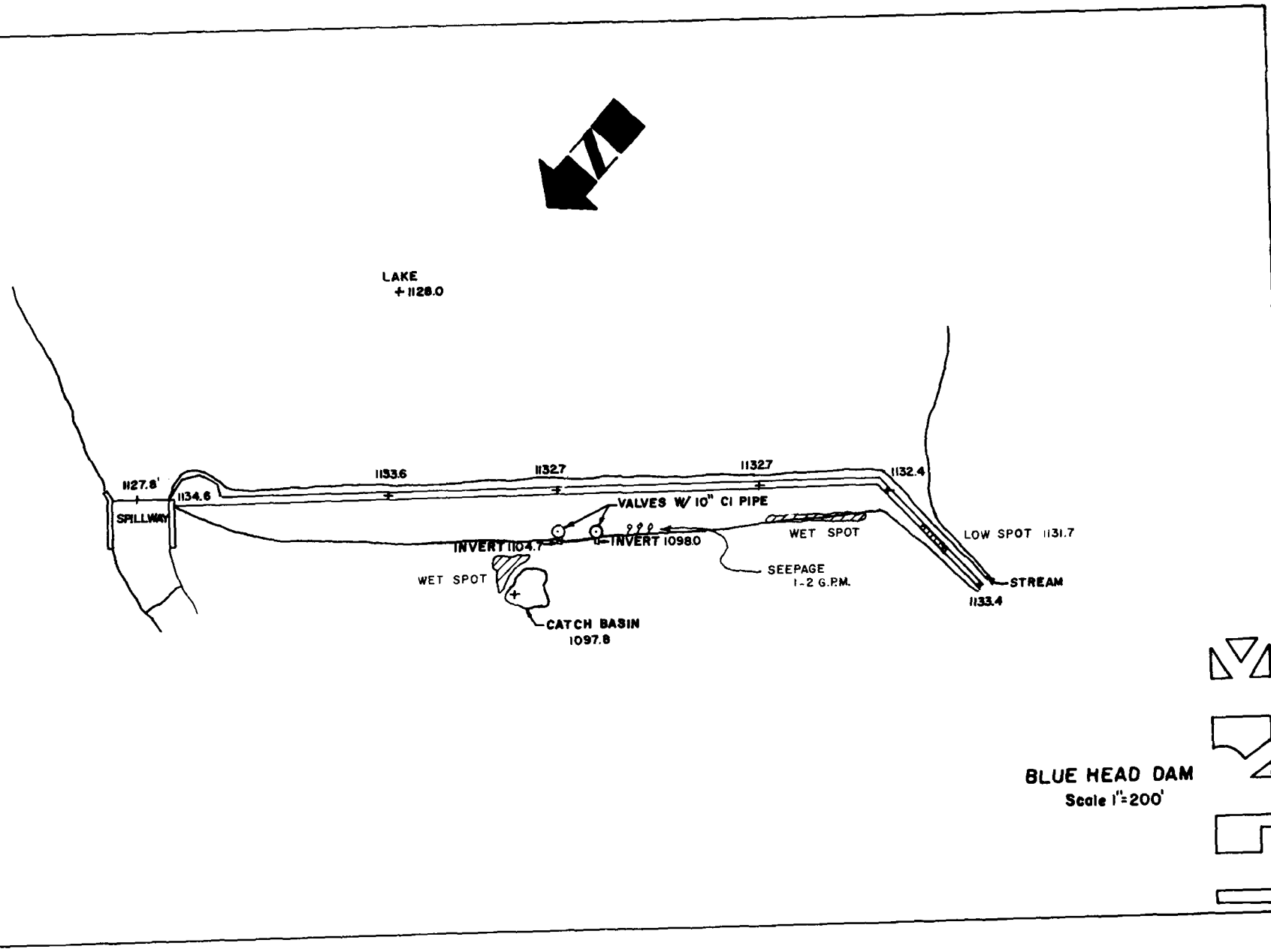
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Moderately wide channel.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Two homes immediately downstream of the dam. Four people.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steep but appear to be stable.	
SEDIMENTATION	Does not appear to be excessive.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



BLUE HEAD DAM
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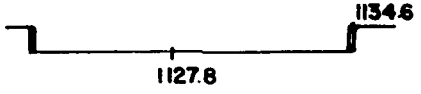
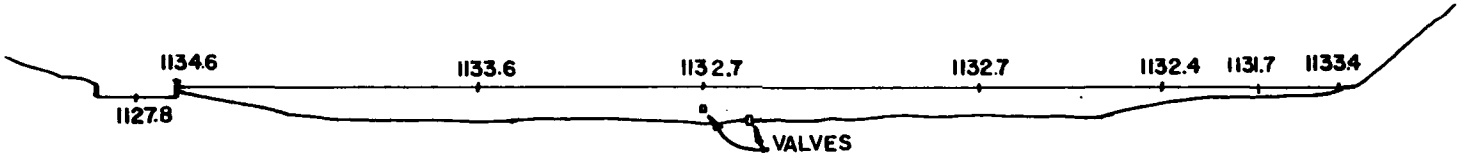
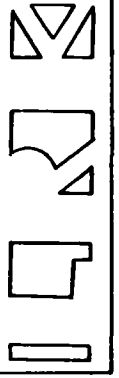


SPILLWAY PROFILE
Scale 1"=50'



PROFILE
LOOKING UPSTREAM



BLUE HEAD DAM
Scale 1"=200'

APPENDIX B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM ~~Blue Head Dam~~

ID# ~~PA 678~~

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	None.
TYPICAL SECTIONS OF DAM	None.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

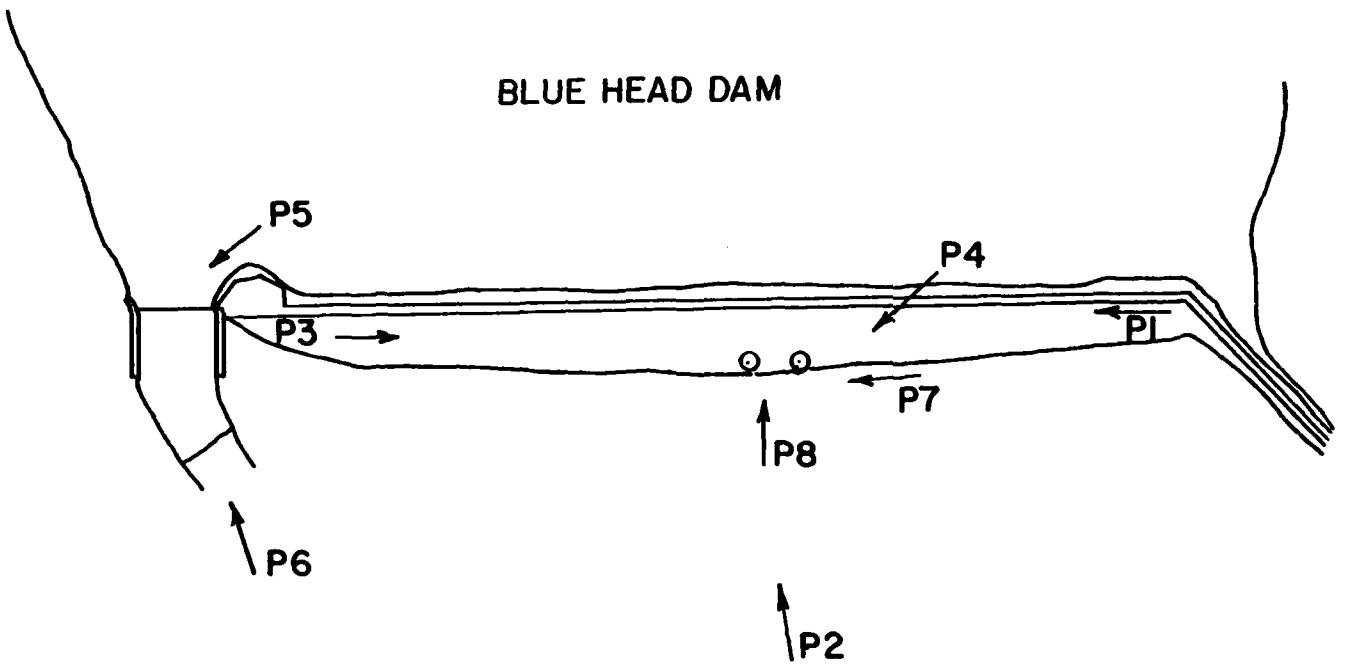
ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Unknown.
POST-CONSTRUCTION SURVEYS OF DAM	Unknown.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Spillway rebuilt twice.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Unknown.
MAINTENANCE OPERATION RECORDS	None.

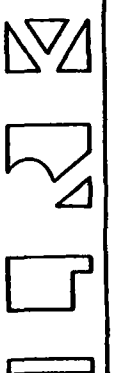
ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Construction drawings in PennDER files.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS

P- INDICATES PHOTO LOCATION



BLUE HEAD DAM
PHOTO INDEX



C1

BLUE HEAD DAM

Photograph Descriptions

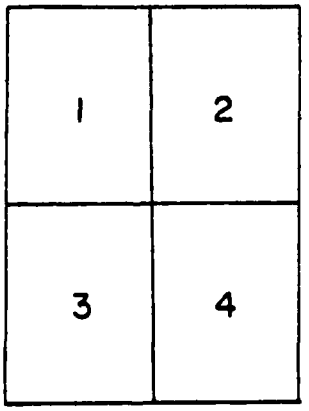
Sheet 1. Front

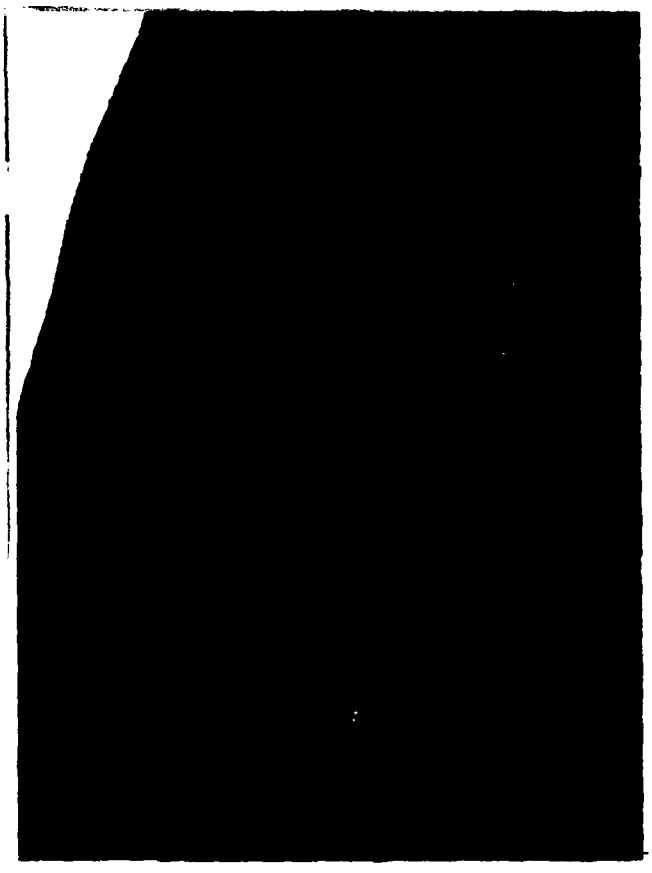
(1) Upper Left - Crest of dam looking toward spillway (right abutment).
(2) Upper right - Downstream slope of dam with intake pond (for pumping station) in foreground.
(3) Lower left - Downstream slope of dam.
(4) Lower right - Caretaker's home and intake pond at toe of dam.

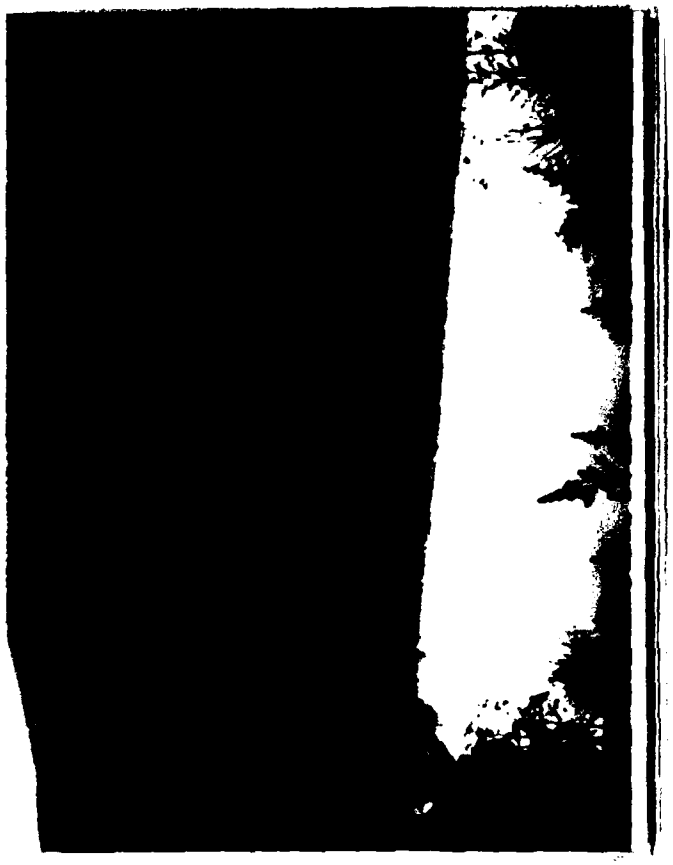
Sheet 1. Back

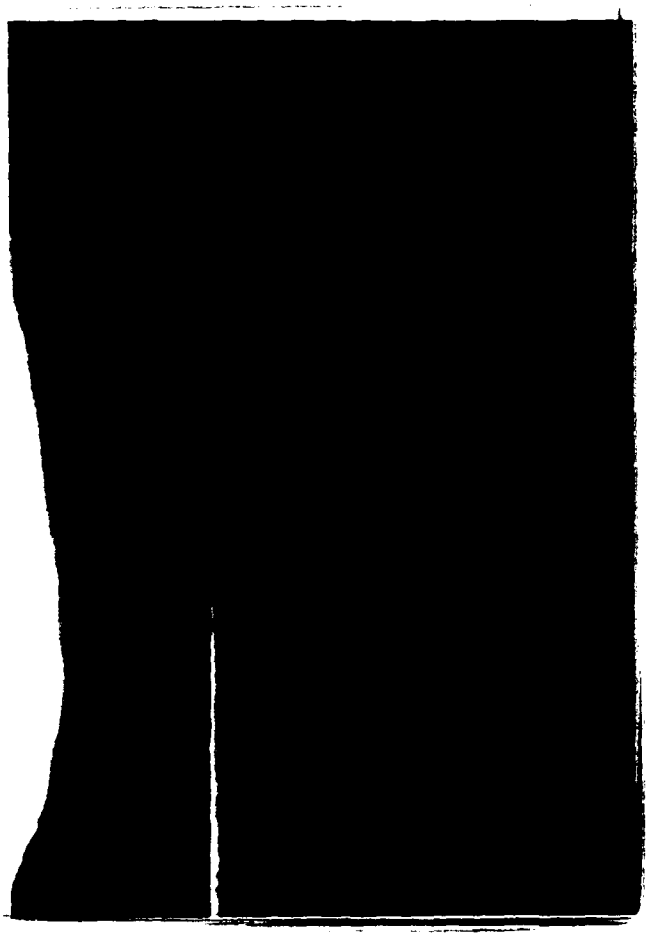
(5) Upper left - Spillway approach.
(6) Upper right - Spillway and weir and exit channel.
(7) Lower left - Blow off valve at downstream toe of dam.
(8) Lower right - Leaking drain valve at toe of dam.

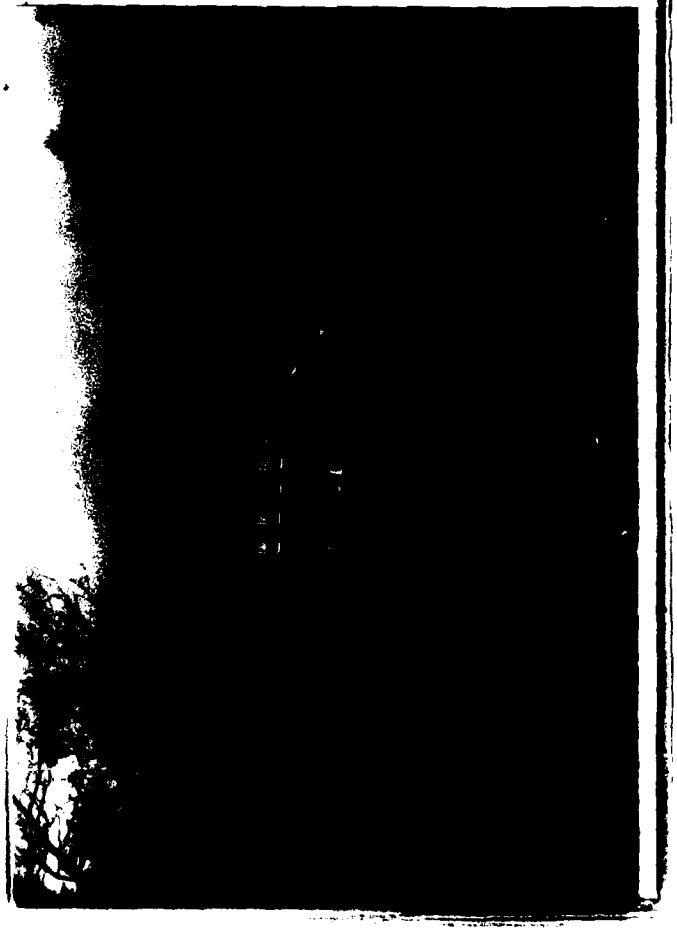
TOP OF PAGE











APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Blue Head Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (1.005) = 22.3 inches

STATION	1	2	3
Station Description	Lofty Dam	Blue Head Dam Sub-area A	Sub-Area B
Drainage Area (square miles)	1.48	2.0	2.2
Cumulative Drainage Area (square miles)	1.48	5.68	
Adjustment of PMF for Drainage Area (%)(1)			
6 hours	117.5	117	
12 hours	127	127	
24 hours	136.5	136	
48 hours	142.5	143	
72 hours	145	145	
Snyder Hydrograph Parameters			
Zone (2)	13	13	
Cp (3)	0.50	0.50	
Ct (3)	1.85	1.85	
L (miles) (4)	1.97	2.1	2.3
Lca (miles) (4)	1.08	1.2	0.95
tp = Ct(LxLca) 0.3 hrs.	2.32	2.44	2.34
Spillway Data			
Crest Length (ft)	29'	86'	
Freeboard (ft)	5'	3.9'	
Discharge Coefficient	3.1'	3.6'	
Exponent	1.5	1.5	

(1) Hydrometeorological Report 40 (Figure 1), U.S. Army Corps of Engineers, 1965.

(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).

(3) Snyder's Coefficients.

(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: DA-5.68 mi^2 wooded, mild slopes

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 98 ac-ft

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 160 ac-ft

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1131.7'

SPILLWAY CREST:

a. Elevation 1167.8'
b. Type Ogee
c. Width 86'
d. Length Unknown
e. Location Spillover Right abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 2 10" CIP's
b. Location Maximum section
c. Entrance inverts Unknown
d. Exit inverts 1104.7' & 1098.0'
e. Emergency draindown facilities 2 10" CIP's

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1          A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
    2          A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF BLUE HEAD DAM
    3          A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR  (PA. 54-371)
    4          B   300      0     15      0      0      0      0      0      0      0
    5          B1    5
    6          J     1      6      1
    7          J1  .3     .4     .5     .6     .7      1
    8          K     0      1                                  1
    9          K1       INFLOW (LOFTY)
   10          M     1      1   1.48
   11          P          22.37  117.5    127  136.5  142.5    145
   12          T                                              1    .05
   13          W  2.32     .5
   14          X  -1.5   -.05      2
   15          K     1      2                                  1
   16          K1       ROUTE THRU LOFTY
   17          Y                          1
   18          Y1    1                                   -1391     -1
   19          Y4 1391   1392   1393   1394   1395 1395.3 1395.5 1395.6 1395.7 1396.4
   20          Y5    0     90    254    467    719    800    927   1065   1231   3313
   21          $A    0     31   54.5
   22          $E1364.3   1391   1400
   23          $$ 1391
   24          $D1395.3
   25          K     1      3                                  1
   26          K1       CHANNEL ROUTING
   27          Y                          1
   28          Y1    1
   29          Y6  .06    .05    .06   1258   1300   6000    .02
   30          Y7    0   1300    150   1280    350   1260    352   1258    356   1258
   31          Y7  358   1260    650   1280    850   1300
   32          K     1      4                                  1
   33          K1       CHANNEL ROUTING
   34          Y                          1
   35          Y1    1
   36          Y6  .06    .05    .06   1126   1160   6000   .022
   37          Y7    0   1160    150   1140    175   1128    177   1126    181   1126
   38          Y7  183   1128    900   1140   1100   1160
   39          K     0      5                                  1
   40          K1       INFLOW SUB-AREA A
   41          M     1      1      2
   42          P          22.3    117    127    136    143    145
   43          T                                            1.0    .05
   44          W  2.44    0.50
   45          X  -1.     -.05    2.0
```

```
46          K       0       6                                                   1
47          K1        INFLOW SUB-AREA B
48          M       1       1       2.2
49          P               22.3    117     127     136     143     145
50          I                                                   1.0     .05

51          W   2.34    0.50
52          X   -1.5    -.05    2.0
53          K       3       7                                                   1
54          K1        COMBINE REACH AND SUB-AREA RUNOFF
55          K       1       8                                                   1
56          K1        ROUTE
57          Y                                       1       1
58          Y1      1                                                   -1127.8
59          $A      0    14.7    17.3    29.4    50.5
60          $E1107.9 1127.8 1131.7  1140    1160
61          $S1127.8    86      3.6     1.5
62          $D1131.7    4.0     1.5     1275
63          $L      30      50      440     830     1250    1300    1400
64          $V1131.7    1132    1132.5  1133    1133.5  1134    1135
65          K       99
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE= 80/03/05.
     TIME= 07.19.36.
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF BLUE HEAD DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA. 54-37)

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= .30 .40 .50 .60 .70 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW (LOFTY)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.48	0.00	1.48	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.37	117.50	127.00	136.50	142.50	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

1/.3

UNIT HYDROGRAPH DATA
TP= 2.32 CP= .50 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.07 AND R=12.63 INTERVALS

UNIT HYDROGRAPH 73 END-OF-PERIOD ORDINATES, LAG= 2.34 HOURS, CP= .50 VOL= 1.00

6.	24.	49.	79.	111.	144.	172.	192.	205.	209.
200.	185.	171.	158.	146.	135.	124.	115.	106.	98.
91.	84.	77.	71.	66.	61.	56.	52.	48.	44.
41.	38.	35.	32.	30.	28.	26.	24.	22.	20.
19.	17.	16.	15.	14.	13.	12.	11.	10.	9.
8.	8.	7.	7.	6.	6.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	1.							

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3115.	2369.	905.	310.	89342.
CMS	88.	67.	26.	9.	2530.
INCHES		14.89	22.76	23.39	23.40
MM		378.16	578.04	594.19	594.30
AC-FT		1175.	1795.	1846.	1846.
THOUS CU M		1449.	2215.	2276.	2277.

D-8

HYDROGRAPH ROUTING

ROUTE THRU LOFTY

ISTAQ	ICOMP	IECON	ITAPE	JPCT	JPRT	IRAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1391.	-1

STAGE	1391.00	1392.00	1393.00	1394.00	1395.00	1395.30	1395.50	1395.60	1395.70
//1396.40									
FLOW	0.00	90.00	254.00	467.00	719.00	800.00	927.00	1065.00	1231.00
//3313.00									
SURFACE AREA=	0.	31.	55.						
CAPACITY=	0.	276.	656.						
ELEVATION=	1364.	1391.	1400.						

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
1391.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1395.3	0.0	0.0	0.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

	QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
•	.0600	.0500	.0600	1258.0	1300.0	6000.	.02000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1300.00 150.00 1280.00 350.00 1260.00 352.00 1258.00 356.00 1258.00
358.00 1260.00 650.00 1280.00 850.00 1300.00

STORAGE	0.00	1.96	14.25	43.10	88.51	150.47	228.99	324.07	435.70
//1563.90									
	708.64	867.33	1037.80	1220.05	1414.07	1619.88	1837.46	2066.82	2307.96
//2560.88									
OUTFLOW	0.00	73.18	576.89	2229.16	5601.36	11174.35	19379.40	30614.26	45251.73
/63645.04									
	86211.51	114646.66	147416.81	184682.36	226607.82	273359.58	325104.52	382009.20	444239.32
511959.39									
STAGE	1258.00	1260.21	1262.42	1264.63	1266.84	1269.05	1271.26	1273.47	1275.68
//1277.89									
	1280.11	1282.32	1284.53	1286.74	1288.95	1291.16	1293.37	1295.58	1297.79
//1300.00									
FLOW	0.00	73.18	576.89	2229.16	5601.36	11174.35	19379.40	30614.26	45251.73
563645.04									
	86211.51	114646.66	147416.81	184682.36	226607.82	273359.58	325104.52	382009.20	444239.32
511959.39									

HYDROGRAPH ROUTING

CHANNEL ROUTING

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1126.0	1160.0	6000.	.02200

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1160.00 150.00 1140.00 175.00 1128.00 177.00 1126.00 181.00 1126.00
183.00 1128.00 900.00 1140.00 1100.00 1160.00

STORAGE	0.00	1.43	14.01	53.68	120.63	214.85	336.34	485.11	660.84
71850.93									
	1048.73	1254.25	1467.49	1688.45	1917.13	2153.53	2397.65	2649.48	2909.04
73176.31									
OUTFLOW	0.00	50.07	445.19	2260.94	6419.03	13670.19	24679.99	40058.48	61072.37
90653.57									
	125372.79	165069.93	209663.29	259112.84	313404.91	372543.91	436547.51	505443.33	579266.74
658059.19									
STAGE	1126.00	1127.79	1129.58	1131.37	1133.16	1134.95	1136.74	1138.53	1140.32
71142.11									
	1143.89	1145.68	1147.47	1149.26	1151.05	1152.84	1154.63	1156.42	1158.21
71160.00									
FLOW	0.00	50.07	445.19	2260.94	6419.03	13670.19	24679.99	40058.48	61072.37
690653.57									
	125372.79	165069.93	209663.29	259112.84	313404.91	372543.91	436547.51	505443.33	579266.74

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW SUB-AREA A

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.00	0.00	2.00	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	117.00	127.00	136.00	143.00	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.44 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.40 AND R=13.21 INTERVALS

UNIT HYDROGRAPH 76 END-OF-PERIOD ORDINATES, LAG= 2.45 HOURS, CP= .50 VOL= 1.00

8.	30.	61.	97.	138.	179.	216.	244.	263.	271.
264.	247.	229.	212.	197.	183.	169.	157.	145.	135.
125.	116.	107.	100.	92.	86.	79.	74.	68.	63.
59.	54.	50.	47.	43.	40.	37.	35.	32.	30.
28.	25.	24.	22.	20.	19.	17.	16.	15.	14.
13.	12.	11.	10.	10.	9.	8.	8.	7.	7.
6.	6.	5.	5.	4.	4.	4.	4.	3.	3.
3.	3.	2.	2.	2.	2.				

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3023.	3130.	1214.	417.	1.0000.
CMS	115.	89.	34.	12.	3400.
INCHES		14.56	22.57	23.27	23.27
MM		369.78	573.32	591.00	591.11
C-FT		1552.	2406.	2481.	2481.
THOUS CU M		1914.	2968.	3060.	3060.

SUB-AREA RUNOFF COMPUTATION

INFLOW SUB-AREA B

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.20	0.00	2.20	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	117.00	127.00	136.00	143.00	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.34 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.13 AND R=12.63 INTERVALS

UNIT HYDROGRAPH 73 END-OF-PERIOD ORDINATES, LAG= 2.36 HOURS, CP= .50 VOL= 1.00

9.	36.	73.	116.	164.	212.	254.	285.	304.	310.
298.	275.	254.	235.	217.	201.	185.	171.	158.	146.
135.	125.	115.	106.	98.	91.	84.	78.	72.	66.
61.	56.	52.	48.	45.	41.	38.	35.	32.	30.
28.	26.	24.	22.	20.	19.	17.	16.	15.	14.
13.	12.	11.	10.	9.	8.	8.	7.	7.	6.
6.	5.	5.	4.	4.	4.	4.	3.	3.	3.
3.	2.	2.							

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4598.	3497.	1337.	459.	132256.
CMS	130.	99.	38.	13.	3745.
INCHES		14.79	22.62	23.30	23.30
MM		375.55	574.55	591.74	591.84
AC-FT		1734.	2653.	2732.	2733.
THOUS CU M		2139.	3272.	3370.	3371.

********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE REACH AND SUB-AREA RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	3	0	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THROUGH BLUE HEAD DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
8	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1128.	0

SURFACE AREA=	0.	15.	17.	29.	51.
CAPACITY=	0.	98.	160.	351.	1141.
ELEVATION=	1108.	1128.	1132.	1140.	1160.

CREL	SPWID	COOW	EXPW	PLPVL	COOL	CAREA	EXPL
1127.8	86.0	3.6	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1131.7	3.0	1.5	1275.

CREST LENGTH AT OR BELOW ELEVATION	30. 1131.7	50. 1132.0	440. 1132.5	830. 1133.0	1250. 1134.5	1300. 1135.0	1400. 1135.0

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .30	RATIO 2 .40	RATIO 3 .50	RATIO 4 .60	RATIO 5 .70	RATIO 6 1.00
HYDROGRAPH AT	1	1.48	1	935.	1246.	1558.	1869.	2181.	3115.
		(3.83)	(	26.46)(	35.29)(	44.11)(	52.93)(	61.75)(	88.22)(
ROUTED TO	2	1.48	1	734.	1141.	1534.	1860.	2171.	3101.
		(3.83)	(	20.77)(	32.30)(	43.44)(	52.67)(	61.47)(	87.80)(
ROUTED TO	3	1.48	1	731.	1126.	1514.	1844.	2155.	3086.
		(3.83)	(	20.71)(	31.89)(	42.88)(	52.22)(	61.04)(	87.38)(
ROUTED TO	4	1.48	1	728.	1105.	1484.	1815.	2132.	3066.
		(3.83)	(	20.61)(	31.28)(	42.03)(	51.39)(	60.36)(	86.83)(
HYDROGRAPH AT	5	2.00	1	1222.	1629.	2036.	2444.	2851.	4073.
		(5.18)	(	34.60)(	46.13)(	57.66)(	69.20)(	80.73)(	115.33)(
HYDROGRAPH AT	6	2.20	1	1379.	1839.	2299.	2759.	3218.	4598.
		(5.70)	(	39.06)(	52.08)(	65.10)(	78.11)(	91.13)(	130.19)(
3 COMBINED	7	5.68	1	3094.	4221.	5601.	6874.	8088.	11659.
		(14.71)	(	87.60)(	119.52)(	158.60)(	194.66)(	229.02)(	330.14)(
ROUTED TO	8	5.68	1	3087.	4218.	5601.	6879.	8076.	11656.
		(14.71)	(	87.41)(	119.45)(	158.60)(	194.80)(	228.69)(	330.06)(

12/13

SUMMARY OF DAM SAFETY ANALYSIS

LOFTY RESERVOIR DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1391.00	1391.00	1395.30
STORAGE	276.	276.	431.
OUTFLOW	0.	0.	800.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	1395.05	0.00	421.	734.	0.00	43.75	0.00
.40	1395.65	.35	445.	1141.	3.00	43.00	0.00
.50	1395.80	.50	452.	1534.	4.50	42.50	0.00
.60	1395.91	.61	457.	1860.	5.50	42.25	0.00
.70	1396.02	.72	461.	2171.	6.50	42.25	0.00
1.00	1396.33	1.03	475.	3101.	8.50	42.25	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.30	731.	1262.6	44.00
.40	1126.	1263.2	43.25
.50	1514.	1263.7	42.75
.60	1844.	1264.1	42.50
.70	2155.	1264.5	42.50
1.00	3086.	1265.2	42.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.30	728.	1129.9	44.25
.40	1105.	1130.2	43.50
.50	1484.	1130.6	43.00
.60	1815.	1130.9	42.75
.70	2132.	1131.2	42.75
1.00	3066.	1131.7	42.75

SUMMARY OF DAM SAFETY ANALYSIS

BLUE HEAD DAM

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1127.80	1127.80	1131.70
STORAGE	98.	98.	160.
OUTFLOW	0.	0.	2385.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	1132.32	.62	171.	3087.	3.75	42.75	0.00
.40	1132.82	1.12	180.	4218.	5.25	43.00	0.00
.50	1133.19	1.49	187.	5601.	6.75	42.75	0.00
.60	1133.44	1.74	192.	6879.	7.50	42.50	0.00
.70	1133.64	1.94	196.	8076.	8.50	42.25	0.00
1.00	1134.13	2.43	206.	11656.	10.75	42.25	0.00

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION  26 FEB 79
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    1                A1      RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
    2                A2      DOWNSTREAM CONDITION DUE TO OVERTOP (BLUE HEAD DAM - PA. 54-37)
    3                A3      PLANS 1,2 &3 ASSUMES BREACH. PLAN 4 ASSUMES NO BREACH.
    4                B   300       0      15       0       0       0       0       0       0       0
    5                B1    5
    6                J     4       1       1
    7                J1   .4
    8                K     0       1                                       1
    9                K1      INFLOW (LOFTY)
   10                M     1       1    1.48                                                      1
   11                P           22.37   117.5     127   136.5   142.5     145
   12                T                                                     1     .05
   13                W  2.32      .5
   14                X  -1.5    -.05       2
   15                K     1       2                                       1
   16                K1      ROUTE THRU LOFTY
   17                Y                                 1       1
   18                Y1    1                                           -1391      -1
   19                Y4 1391    1392    1393    1394    1395  1395.3  1395.5  1395.6  1395.7  1396.4
   20                Y5    0      90     254     467     719     800     927    1065    1231    3313
   21                $A    0      31    54.5
   22                $F1364.3    1391    1400
   23                $$ 1391
   24                $D1395.3
   25                $B   50      .5    1367       1    1391  1395.6
   26                $B   50      .5    1367       2    1391  1395.6
   27                $B   50      .5    1367       3    1391  1395.6
   28                $B   50      .5    1367       3    1391  1400.0
   29                K     1       3                                       1
   30                K1      CHANNEL ROUTING
   31                Y                                 1       1
   32                Y1    1
   33                Y6  .06     .05     .06    1258    1300    6000     .02
   34                Y7    0    1300     150    1280     350    1260     352    1258     356    1258
   35                Y7  358    1260     650    1280     650    1300
   36                K     1       4                                       1
   37                K1      CHANNEL ROUTING
   38                Y                                 1       1
   39                Y1    1
   40                Y6  .06     .05     .06    1126    1160    6000    .022
   41                Y7    0    1160     150    1140     175    1128     177    1126     181    1126
   42                Y7  181    1128     900    1140    1100    1160
   43                K     0       5                                       1
   44                K1      INFLOW SUB-AREA A
   45                M     1       1       2                                                 1
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46              P          22.3     .117     127      136      143      145
47              T                                                    1.0      .05
48              W   2.44    0.50
49              X   -1.5    -.05     2.0
50              K      0       6                                      1
51              K1       INFLOW SUB-AREA B
52              M      1       1      .2                                                  1
53              P          27.3     117      127      136      143      145
54              T                                                    1.0      .05
55              W   2.44    0.50
56              X   -1.5    -.05     2.0
57              K      3       7                                      1
58              K1       COMBINE REACH AND SUB-AREA RUNOFF
59              K      1       8                                      1
60              K1       ROUTE
61              Y                                1       1
62              Y1     1                                                    =1127.8
63              $A     0    14.7     17.3     29.4     50.5
64              $E1107.9  1127.8   1131.7     1140     1160
65              $S1127.8       8        3.6      1.5
66              $D1131.7       3.0      1.5      1275
67              $L    30      50       440      830      1250     1300     1400
68              $V1131.7     1132     1132.5     1133     1133.5     1134     1135
69              $B    50      .5       1108       1     1127.8   1132.8
70              $B    50      .5       1108       2     1127.8   1132.8
71              $B    50      .5       1108       3     1127.8   1132.8
72              $B    50      .5       1108       3     1127.8   1135.0
73              K      1       9                                      1
74              K1       CHANNEL ROUTING - REACH 1
75              Y                                1       1
76              Y1     1
77              Y6   .06      .05      .06      1028     1060     6800     0.01
78              Y7     0    1060      100      1040      245     1030      247     1028      250     1028
79              Y7   252    1030     1250      1040     1400     1060
80              K      1      10                                      1
81              K1       CHANNEL ROUTING - REACH 2
82              Y                                1       1
83              Y1     1
84              Y6   .06      .05      .06       978     1020     7900    0.006
85              Y7     0    1020       50      1000      245      980      247      978      250      978
86              Y7   252     980      750      1000     1150     1020
87              K      1      11                                      1
88              K1       CHANNEL ROUTING - REACH 3
89              Y                                1       1
90              Y1     1
91              Y6   .06      .05      .06       948      980     7900    0.004
92              Y7     0     980      250       960      580      950      585      948      595      948
93              Y7   600     950      850       960      950      980
94              K     99
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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 80/03/10.
TIME= 12.51.04.

RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
DOWNSTREAM CONDITION DUE TO OVERTOP (BLUE HEAD DAM - PA. 54-371)
PLANS 1,2 &3 ASSUMES BREACH. PLAN 4 ASSUMES NO BREACH.

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 4 NRTIO= 1 LRTIO= 1

RTIOS= .40

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SUB-AREA RUNOFF COMPUTATION

INFLOW (LOFTY)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.48	0.00	1.48	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.37	117.50	127.00	136.50	142.50	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 2.32 CP= .50 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.07 AND R=12.63 INTERVALS

UNIT HYDROGRAPH 73 END-OF-PERIOD ORDINATES. LAG= 2.34 HOURS. CP= .50 VOL= 1.00

6.	24.	49.	79.	113.	144.	172.	192.	205.	209.
206.	195.	171.	158.	146.	134.	124.	115.	106.	98.
91.	84.	77.	71.	66.	61.	56.	52.	48.	44.
41.	38.	35.	32.	30.	28.	26.	24.	22.	20.
19.	17.	16.	15.	14.	13.	12.	11.	10.	9.
8.	8.	7.	7.	6.	6.	5.	5.	4.	4.
4.	4.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	1.							

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3115.	2369.	905.	310.	89542.
CMS	88.	67.	26.	9.	2530.
INCHES		14.89	22.76	23.39	23.40
MM		378.16	578.04	594.19	594.30
AC-FT		1175.	1795.	1846.	1846.
THOUS CU M		1449.	2215.	2276.	2277.

5/20

HYDROGRAPH ROUTING

ROUTE THRU LOFTY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPNP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1391.	-1

STAGE	1391.00	1392.00	1393.00	1394.00	1395.00	1395.30	1395.50	1395.60	1395.70
1396.40									
FLOW	0.00	90.00	254.00	467.00	719.00	800.00	927.00	1065.00	1231.00
1315.00									
SURFACE AREA=	0.	31.	55.						
CAPACITY=	0.	276.	656.						
ELEVATION=	1364.	1391.	1400.						

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1391.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1395.3	0.0	0.0	0.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	1367.00	1.00	1391.00	1395.60

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	1367.00	2.00	1391.00	1395.60

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	1367.00	4.00	1391.00	1395.60

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	1367.00	8.00	1391.00	1395.60

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HYDROGRAPH ROUTING

CHANNEL ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1258.0	1300.0	6000.	.02000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1300.00 150.00 1280.00 350.00 1260.00 352.00 1258.00 356.00 1258.00
358.00 1260.00 650.00 1280.00 850.00 1300.00

STORAGE	0.00	1.96	14.25	43.10	88.51	150.47	228.99	324.07	435.70
...563.90									
	708.64	867.33	1037.80	1220.05	1414.07	1619.88	1837.46	2066.82	2307.96
..2560.88									
OUTFLOW	0.00	73.18	576.89	2229.16	5601.36	11174.35	19379.40	30614.26	45251.73
63605.04									
	86211.51	114646.66	147416.81	184687.36	226607.82	273359.58	325104.52	382009.20	444239.42
511959.39									
STAGE	1258.00	1260.21	1262.42	1264.63	1266.84	1269.05	1271.26	1273.47	1275.68
..1277.89									
	1280.11	1282.32	1284.53	1286.74	1288.95	1291.16	1293.37	1295.58	1297.79
..1300.00									
FLOW	0.00	73.18	576.89	2229.16	5601.36	11174.35	19379.40	30614.26	45251.73
63605.04									
	86211.51	114646.66	147416.81	184687.36	226607.82	273359.58	325104.52	382009.20	444239.42
511959.39									

HYDROGRAPH ROUTING

CHANNEL ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELDVT	ELMAX	RLNTH	SEL
.0500	.0500	.0600	1126.0	1160.0	6000.	.02200

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1160.00 150.00 1140.00 175.00 1128.00 177.00 1126.00 181.00 1126.00
183.00 1128.00 900.00 1140.00 1100.00 1160.00

STORAGE	0.00	1.43	14.01	53.68	120.63	214.85	336.34	485.11	660.84
..1853.93									
	1048.73	1254.25	1467.49	1688.45	1917.13	2153.53	2397.65	2649.48	2909.04
..3176.31									
OUTFLOW	0.00	50.07	445.19	2260.94	6419.03	13670.19	24679.99	40058.48	61072.37
590653.57									
	125372.79	165069.93	209663.29	259112.84	313404.91	372543.91	436547.51	505443.33	579266.74
658059.19									
STAGE	1126.00	1127.79	1129.58	1131.37	1133.16	1134.95	1136.74	1138.53	1140.32
..1142.11									
	1143.89	1145.68	1147.47	1149.26	1151.05	1152.84	1154.63	1156.42	1158.21
..1160.00									
FLOW	0.00	50.07	445.19	2260.94	6419.03	13670.19	24679.99	40058.48	61072.37
590653.57									
	125372.79	165069.93	209663.29	259112.84	313404.91	372543.91	436547.51	505443.33	579266.74
658059.19									

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SUB-AREA RUNOFF COMPUTATION

INFLOW SUB-AREA A

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.00	0.00	2.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	P45	R6	R12	R24	R48	R72	R96
0.00	22.30	117.00	127.00	136.00	143.00	145.00	0.00

IRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.44 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.40 AND R=13.21 INTERVALS

UNIT HYDROGRAPH 76 END-OF-PERIOD ORDINATES, LAG= 2.45 HOURS, CP= .50 VOL= 1.00

8.	30.	61.	97.	138.	179.	216.	244.	263.	271.	
264.	247.	229.	212.	197.	183.	169.	157.	145.	135.	
125.	116.	107.	100.	92.	86.	79.	74.	68.	63.	
59.	54.	50.	47.	43.	40.	37.	35.	32.	30.	
28.	25.	24.	22.	20.	19.	17.	16.	15.	14.	
13.	12.	11.	10.	10.	9.	8.	8.	7.	7.	
6.	6.	5.	5.	4.	4.	4.	4.	3.	3.	
3.	3.	2.	2.	2.	2.					

SUM	25.87	23.25	2.62	120079.
	(657.1(	591.1(	66.1(| 3400.26)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4073.	3130.	1213.	417.	120083.
CMS	115.	89.	34.	12.	3400.
INCHES		14.56	22.57	23.27	23.27
MM		369.78	573.32	591.00	591.11
AC-FT		1552.	2406.	2481.	2481.
THOUS CU M		1914.	2968.	3060.	3060.

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SUB-AREA RUNOFF COMPUTATION

INFLOW SUB-AREA B

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISAME	LOCAL
1	1	2.20	0.00	2.20	0.00	0.000	0	1	0

PRECIP DATA

SPFE	P6S	R6	R12	R24	R48	R72	R96
0.00	22.30	117.00	127.00	136.00	143.00	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .809

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.34 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.13 AND R=12.63 INTERVALS

UNIT HYDROGRAPH 73 END-OF-PERIOD ORDINATES. LAG= 2.36 HOURS. CP= .50 VOL= 1.00

0.	36.	73.	116.	164.	212.	254.	285.	304.	310.
298.	275.	254.	235.	217.	201.	185.	171.	158.	146.
135.	125.	115.	106.	98.	91.	84.	78.	72.	66.
61.	56.	52.	48.	45.	41.	38.	35.	32.	30.
28.	26.	24.	22.	20.	19.	17.	16.	15.	14.
13.	12.	11.	10.	9.	8.	8.	7.	7.	6.
6.	5.	5.	4.	4.	4.	4.	3.	3.	3.
3.	2.	2.							

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4598.	3497.	1437.	459.	132256.
CMS	130.	99.	38.	13.	3745.
INCHES		14.79	22.62	23.30	23.30
MM		375.55	574.55	591.74	591.84
AC-FT		1734.	2653.	2732.	2733.
THOUS CU M		2139.	3272.	3370.	3371.

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COMBINE HYDROGRAPHS

COMBINE REACH AND SUB-AREA RUNOFF

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	2	3	0	0	0	1	0	0

0.4 PMF for Plan 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10114.	4262.	1528.	522.	150475.
CMS	286.	121.	43.	15.	4261.
INCHES		6.98	10.01	10.27	10.27
MM		177.28	254.25	260.78	260.81
AC-FT		2113.	3031.	3109.	3109.
THOUS CU M		2607.	3738.	3834.	3835.

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HYDROGRAPH ROUTING

ROUTE THROUGH BLUE HEAD DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
8	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1128.	0

SURFACE AREA=	0.	15.	17.	29.	51.
CAPACITY=	0.	96.	160.	951.	1141.
ELEVATION=	1108.	1128.	1132.	1140.	1160.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1127.9	96.0	3.6	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1131.7	3.0	1.5	1275.

CREST LENGTH AT OR BELOW ELEVATION	30. 1131.7	50. 1132.0	440. 1132.5	830. 1133.0	1250. 1133.5	1300. 1134.0	1400. 1135.0

DAM BREACH DATA

BRWID	Z	FLNM	TFAIL	WSEL	FAILEL
50.	.50	1108.00	1.00	1127.80	1132.80

OVN

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	1108.00	2.00	1127.80	1132.80

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	1108.00	3.00	1127.80	1132.80

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	1108.00	3.00	1127.80	1135.00

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HYDROGRAPH ROUTING

CHANNEL ROUTING - REACH 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
0	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	1028.0	1060.0	6800.	.01000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1060.00 100.00 1040.00 245.00 1030.00 247.00 1028.00 250.00 1028.00
252.00 1030.00 1250.00 1040.00 1400.00 1060.00

STORAGE	0.00	1.23	19.76	88.03	206.91	376.41	596.52	867.24	1171.32
1481.28									
	1796.78	2117.81	2444.38	2776.49	3114.13	3457.30	3806.01	4160.26	4520.04
4885.35									
OUTFLOW	0.00	23.76	306.84	1973.32	6032.10	13292.89	24470.40	40218.14	64610.15
694317.10									
	128540.34	167078.87	209781.90	256532.99	307240.41	361830.93	420245.62	482436.83	548366.03
618002.17									
STAGE	1028.00	1029.68	1031.47	1033.05	1034.74	1036.42	1038.11	1039.79	1041.47
1043.16									
	1044.84	1046.53	1048.21	1049.89	1051.58	1053.26	1054.95	1056.63	1058.32
1060.00									
FLOW	0.00	23.76	306.84	1973.32	6032.10	13292.89	24470.40	40218.14	64610.15
694317.10									
	128540.34	167078.87	209781.90	256532.99	307240.41	361830.93	420245.62	482436.83	548366.03
618002.17									

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HYDROGRAPH ROUTING

CHANNEL ROUTING - REACH 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10	1	0	0	0	0		0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	978.0	1020.0	7900.	.00600

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1020.00 50.00 1000.00 245.00 980.00 247.00 978.00 250.00 978.00
252.00 980.00 750.00 1000.00 1150.00 1020.00

STORAGE	0.00	2.22	23.80	75.10	157.59	270.80	414.71	589.33	794.65
..1030.68									
	1297.41	1588.96	1900.44	2231.87	2583.24	2954.54	3345.79	3756.98	4188.10
..4639.16									
OUTFLOW	0.00	32.29	354.18	1532.13	4011.71	8166.82	14332.29	22816.61	33908.73
647382.28									
	65072.96	87035.97	112313.79	140999.97	173196.22	208999.99	248522.96	291870.13	339149.08
390467.63									
STAGE	978.00	980.21	982.42	984.63	986.84	989.05	991.26	993.47	995.68
..4997.89									
	1000.11	1002.32	1004.53	1006.74	1008.95	1011.16	1013.37	1015.58	1017.79
..1020.00									

FLOW	0.00	32.29	354.18	1532.13	4011.71	8166.82	14332.29	22816.61	33908.73
347882.28									
	65072.96	87035.97	112313.79	140999.97	173196.22	208999.99	248522.96	291870.13	339149.08
390467.63									

HYDROGRAPH ROUTING

CHANNEL ROUTING - REACH 4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11	1	1	0	0	0	1	0	0

ALL PLANS HAVE SAME

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	948.0	980.0	7900.	.00400

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 980.00 150.00 960.00 580.00 950.00 585.00 948.00 595.00 948.00

600.00 950.00 850.00 960.00 950.00 980.00

STORAGE	0.00	4.34	20.25	65.52	140.63	249.58	380.36	544.98	731.46
1927.11	1131.76	1345.41	1568.05	1799.72	2040.38	2290.04	2548.71	2816.38	3093.05
3375.72									
OUTFLOW	0.00	52.43	[illegible]	[illegible]	2591.86	[illegible]	[illegible]	14666.70	[illegible]
[illegible]	43719.31	56545.83	[illegible]	[illegible]	104236.42	[illegible]	[illegible]	165981.41	[illegible]
215197.30									
STAGE	948.00	949.68	951.37	953.05	954.74	956.42	958.11	959.79	961.47
963.16	964.84	966.53	968.21	[illegible]	971.58	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]									
FLOW	0.00	52.43	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
232425.06	43719.31	[illegible]	[illegible]	[illegible]	104236.42	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]									

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS .40
HYDROGRAPH AT	1	1.48 (3.83)	1	1246. (35.29)
			2	1246. (35.29)
			3	1246. (35.29)
			4	1246. (35.29)
ROUTED TO	2	1.48 (3.83)	1	8823. (249.83)
			2	5266. (149.13)
			3	3921. (111.03)
			4	1141. (32.30)
ROUTED TO	3	1.48 (3.83)	1	7736. (219.07)
			2	5068. (143.52)
			3	3846. (108.92)
			4	1126. (31.89)
ROUTED TO	4	1.48 (3.83)	1	7328. (207.49)
			2	4917. (139.22)
			3	3756. (106.36)
			4	1105. (31.28)
HYDROGRAPH AT	5	2.00	1	1629.

		(5.18)	(46.13)(	
			2 1629.	
			(46.13)(	
			3 1629.	
			(46.13)(	
			4 1629.	
			(46.13)(	
HYDROGRAPH AT	6	2.20	1 1839.	
		(5.70)	(52.08)(	

			2	1839.
				(52.08)(
			3	1839.
				(52.08)(
			4	1839.
				(52.08)(
3 COMBINED	7	5.69	1	10114.
		(14.71)		(286.41)(
			2	7370.
				(208.69)(
			3	6041.
				(171.07)(
			4	4221.
				(119.52)(
ROUTED TO	8	5.68	1	10266.
		(14.71)		(290.71)(
			2	8932.
				(252.92)(
			3	7152.
				(202.52)(
			4	4218.
				(119.45)(
ROUTED TO	9	5.68	1	9432.
		(14.71)		(267.08)(
			2	8401.
				(237.90)(
			3	6893.
				(195.18)(
			4	4189.
				(118.62)(
ROUTED TO	10	5.68	1	8891.
		(14.71)		(251.76)(
			2	7865.
				(222.72)(
			3	6673.
				(188.95)(
			4	4147.
				(117.44)(
ROUTED TO	11	5.68	1	8129.
		(14.71)		(230.20)(
			2	7330.
				(207.57)(
			3	6424.
				(181.90)(
			4	4063.
				(115.04)(

SUMMARY OF DAM SAFETY ANALYSIS

LOFTY RESERVOIR DAM

		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	1391.00	1391.00	1395.30
	STORAGE	276.	276.	431.
	OUTFLOW	0.	0.	800.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1395.63	.33	445.	8847.	.94	43.52	42.75

PLAN 2

		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	1391.00	1391.00	1395.30
	STORAGE	276.	276.	431.
	OUTFLOW	0.	0.	800.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1395.63	.33	445.	5288.	1.04	43.98	42.75

PLAN 3

		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	1391.00	1391.00	1395.30
	STORAGE	276.	276.	431.
	OUTFLOW	0.	0.	800.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1395.63	.33	445.	3921.	1.13	44.31	42.75

PLAN 4

		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	1391.00	1391.00	1395.30
	STORAGE	276.	276.	431.
	OUTFLOW	0.	0.	800.

RATIO OF	MAXIMUM RESERVOIR	MAXIMUM DEPTH	MAXIMUM STORAGE	MAXIMUM OUTFLOW	DURATION OVER TOP	TIME OF MAX OUTFLOW	TIME OF FAILURE

PMF	W.S.ELEV	OVER DAM	AC-FT	CFS	HOURS	HOURS	HOURS
.40	1305.65	.35	445.	1191.	3.00	43.00	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS

.40	7736.	1267.7	43.75

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	5068.	1266.5	44.00

PLAN 3 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	3846.	1265.7	44.50

PLAN 4 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	1126.	1263.2	43.25

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	7328.	1133.4	43.75

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	4917.	1132.5	44.25

PLAN 3 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	3756.	1132.0	44.50

PLAN 4 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	1105.	1130.2	43.50

SUMMARY OF DAM SAFETY ANALYSIS

BLUE HEAD DAM

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1127.80	1127.80	1131.70
STORAGE	98.	98.	160.
OUTFLOW	0.	0.	2385.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1132.81	1.11	180.	10266.	2.31	43.50	42.50

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1127.80	1127.80	1131.70
STORAGE	98.	98.	160.
OUTFLOW	0.	0.	2385.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1132.81	1.11	180.	8932.	2.54	44.25	42.50

PLAN 3 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1127.80	1127.80	1131.70
STORAGE	98.	98.	160.
OUTFLOW	0.	0.	2385.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1132.81	1.11	180.	7184.	2.81	44.69	42.50

PLAN 4 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1127.80	1127.80	1131.70
STORAGE	98.	98.	160.
OUTFLOW	0.	0.	2385.

RATIO OF	MAXIMUM RESERVOIR	MAXIMUM DEPTH	MAXIMUM STORAGE	MAXIMUM OUTFLOW	DURATION OVER TOP	TIME OF MAX OUTFLOW	TIME OF FAILURE

PMF	W.S.ELEV	OVER DAM	AC-FT	CFS	HOURS	HOURS	HOURS
.40	1132.82	1.17	180.	4218.	5.25	43.00	0.00

PLAN 1 STATION 9

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS

.40	9432.	1035.5	44.00

PLAN 2 STATION 9

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	8401.	1035.3	44.50

PLAN 3 STATION 9

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	6893.	1034.9	44.75

PLAN 4 STATION 9

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	4189.	1034.0	43.25

PLAN 1 STATION 10

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	8891.	989.3	44.25

PLAN 2 STATION 10

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	7865.	988.9	44.75

PLAN 3 STATION 10

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	6673.	988.3	45.00

PLAN 4 STATION 10

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	4147.	986.9	43.50

PLAN 1 STATION 11

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	8129.	957.7	44.50

PLAN 2 STATION II

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	7330.	957.3	45.00

PLAN 3 STATION II

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	6424.	956.9	45.50

PLAN 4 STATION II

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	4063.	955.7	44.00

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME BLUE HEAD DAM
I.D. NUMBER PA. 54-37
SHEET NO. 1 OF 4
BY OTM DATE 3-15-80

LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY THE BALTIMORE DISTRICT CORPS OF ENGINEERS.

STRTL = 1 INCH
CNSTL = 0.05 IN/HR
STRTQ = 1.5 cfs/M.^{2}
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2.0

ELEVATION - AREA - CAPACITY RELATIONSHIPS

FROM U.S.G.S. 7.5-MIN. QUAD., DER FILES AND FIELD INSPECTION DATA.

AT SPILLWAY CREST ELEVATION = 1127.8'
INITIAL STORAGE = 97.5 ac.ft
POND SURFACE AREA = 14.7 ac.

AT ELEV. 1140, AREA = 29.4 ac.
" " 1160, " = 50.5 ac.

FROM THE CONIC METHOD FOR RESERVOIR VOLUME. FLOOD HYDROGRAPH PACKAGE (HEC-1), DAM SAFETY VERSION (USER'S MANUAL).

$H = 3V/A = 3(97.5)/14.7 = 19.9'$

ELEVATION WHERE AREA EQUALS ZERO;

$1127.8' - 19.9' = 1107.9'$

AREA (Ac)	0	14.7	17.3	29.4	50.5
ELEV. (FT.)	1107.9	1127.8	1131.7	1140	1160

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CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME BLUE HEAD DAM
I.D. NUMBER PA. 54-37
SHEET NO. 2 OF 4
BY OTM DATE 3-15-80

DISCHARGE RATING CURVE

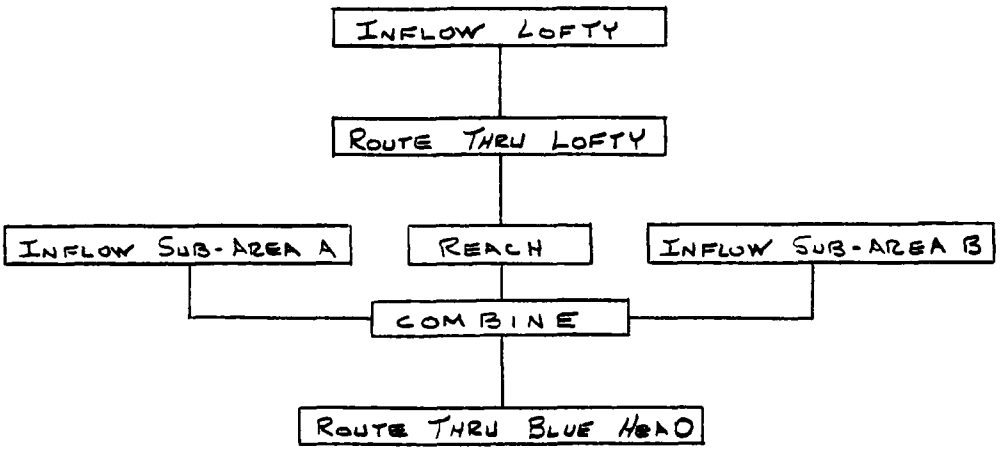
DETERMINED BY (HEC-1).

SPILLWAY CREST ELEVATION = 1127.8'
WEIR LENGTH = 86'
COEFFICIENT OF DISCHARGE (C) = 3.6 (OGEE)

OVERTOP PARAMETERS

TOP OF DAM ELEVATION (LOW SPOT) = 1131.7'
LENGTH OF DAM (EXCLUDING SPILLWAY) = 1275'
COEFFICIENT OF DISCHARGE (C) = 3.0 (BROAD CREST)
#L MAX. = 1400', #V MAX. = 1135'

PROGRAM SCHEDULE



NOTE:
INPUT FOR LOFTY FROM APRIL, 1979 PHASE I. DATA REVIEWED AND INCORPORATED IN BLUE HEAD ANALYSIS.

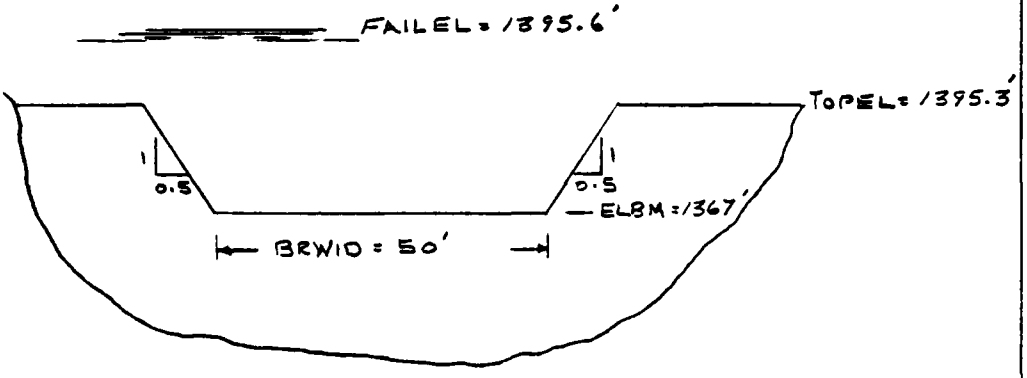
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME BLUE HEAD DAM
I.D. NUMBER PA. 54-37
SHEET NO. 3 OF 4
BY OTM DATE 3-15-80

DAM BREACH PARAMETERS

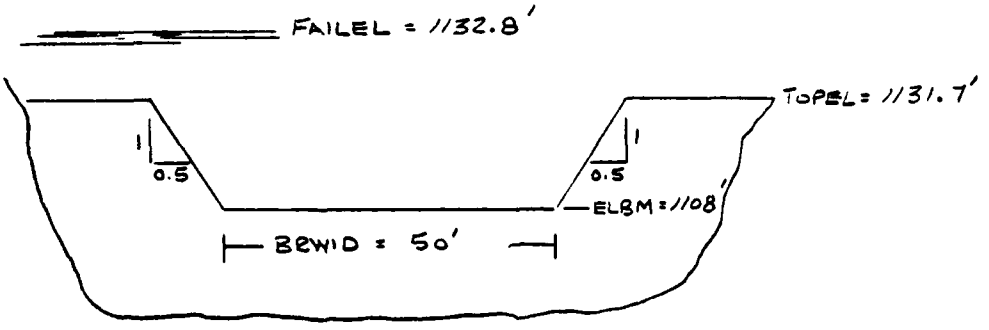
LOFTY OVERTOP REVIEWED AND BREACH CONSIDERED.

(LOFTY)



RATIO OF PMF (RTIO) = 0.4
SIDE SLOPE OF BREACH (Z) = 0.5
FAILURE TIME (TFAIL) = 1, 2 & 3 HRS.
DEPTH OF OVERTOP = 0.3' OR 3.6"

(BLUE HEAD)



RATIO OF PMF (RTIO) = 0.4
SIDE SLOPE OF BREACH (Z) = 0.5
FAILURE TIME (TFAIL) = 1, 2 & 3 HRS.
DEPTH OF OVERTOP = 1.1' OR 13.2"

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EBENSBURG PENNSYLVANIA

DAM NAME BLUE HEAD DAM
I.D. NUMBER PA. 54-37
SHEET NO. 4 OF 4
BY OTM DATE 3-15-80

CHANNEL ROUTING

CHANNEL ROUTING CROSS SECTIONS OBTAINED FROM U.S.G.S. 7.5-MIN. QUAD.

CHANNEL MANNING'S n (QN 2) = 0.05
OVERBANK MANNING'S n (QN 1) = 0.06

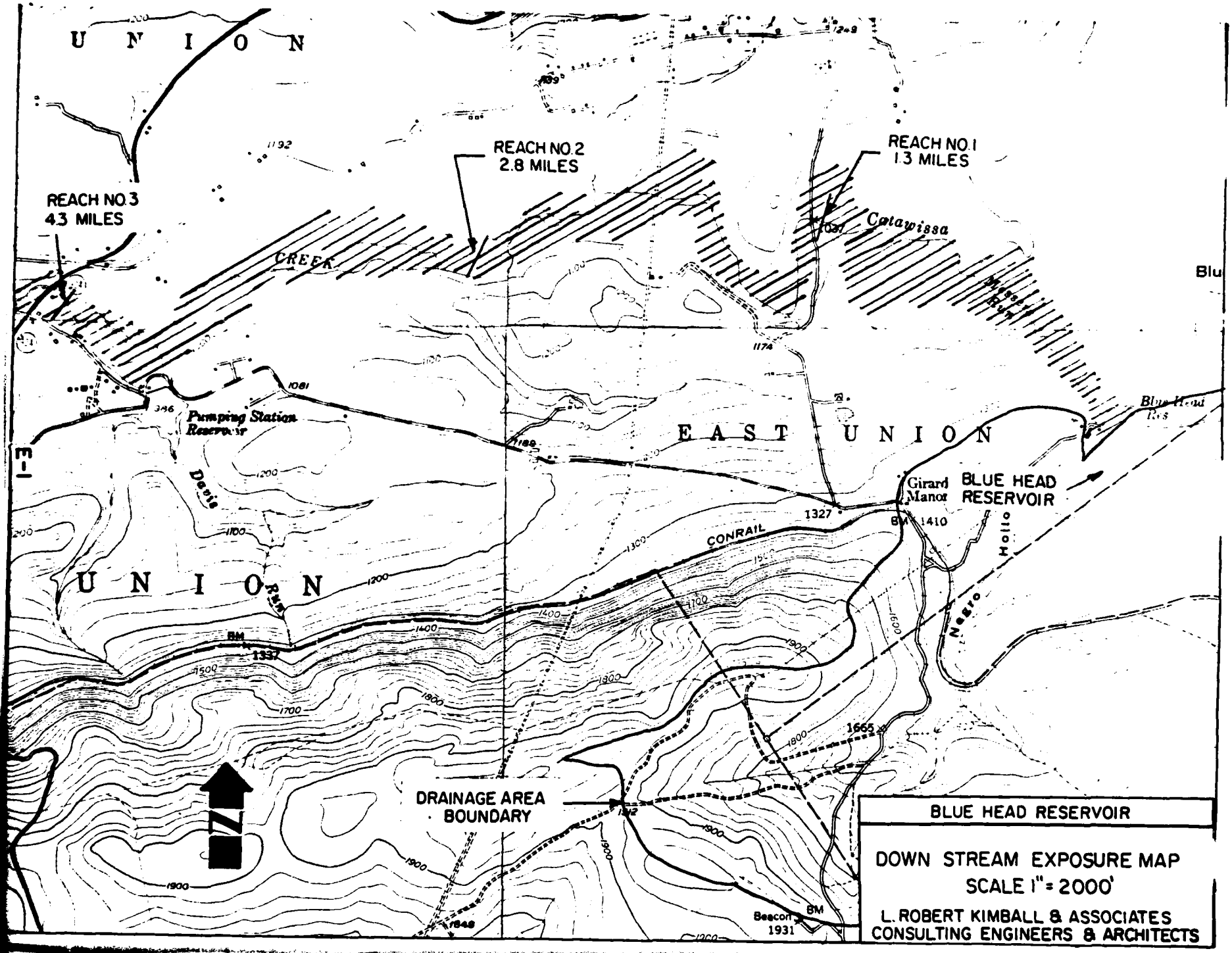
APPENDIX E
DRAWINGS

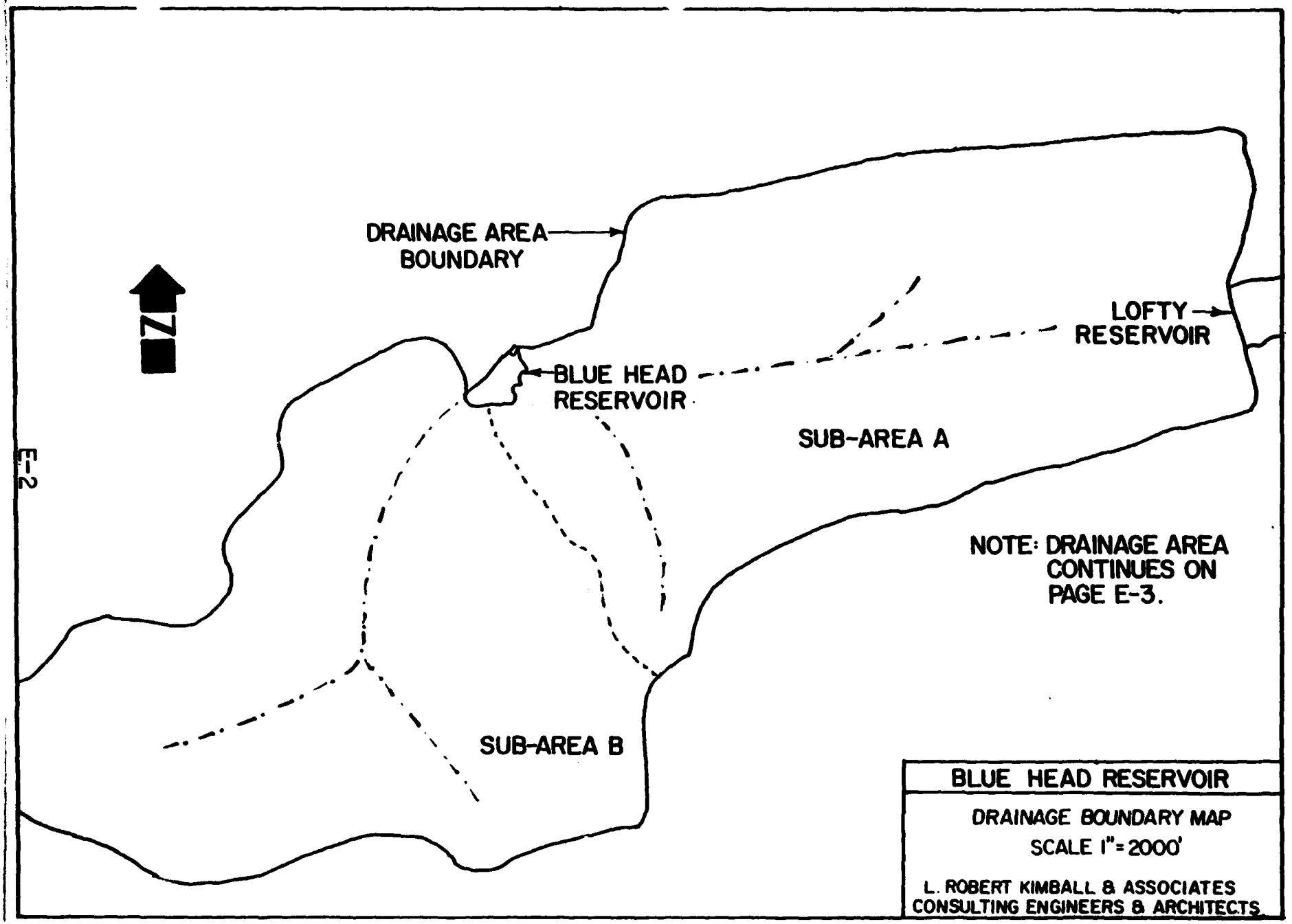
AD-A085 273 KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. BLUE HEAD DAM (NDS ID NUMBER P--ETC(U)
APR 80 R J KIMBALL DACW31-80-C-0020

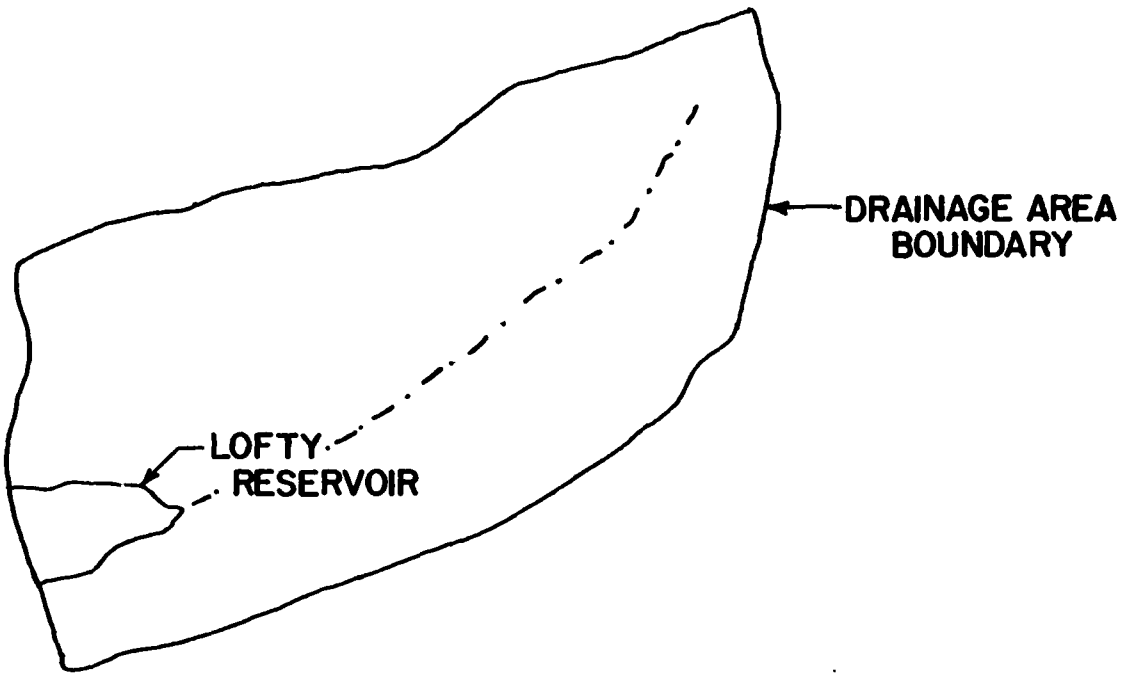
UNCLASSIFIED NL

2 OF 2
AD A085 273

END
DATE FILMED
7-80
DTIC


U N I O N
REACH NO.3
4.3 MILES
REACH NO.2
2.8 MILES
REACH NO.1
1.3 MILES
CREEK
Catawissa
Pumping Station
Reservoir
E-1
Devils
Run
EAST UNION
Girard
Manor
BLUE HEAD
RESERVOIR
CONRAIL
U N I O N
Run
BM
1337
1327
BM
1410
Hollo
Negro
1665
DRAINAGE AREA
BOUNDARY
Beacon
1931
BM
BLUE HEAD RESERVOIR
DOWN STREAM EXPOSURE MAP
SCALE 1" = 2000'
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS


DRAINAGE AREA BOUNDARY
N
LOFTY RESERVOIR
BLUE HEAD RESERVOIR
SUB-AREA A
NOTE: DRAINAGE AREA CONTINUES ON PAGE E-3.
SUB-AREA B
BLUE HEAD RESERVOIR
DRAINAGE BOUNDARY MAP
SCALE 1"=2000'
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



N

LOFTY RESERVOIR

DRAINAGE BOUNDARY AREA
SCALE 1" = 2000'

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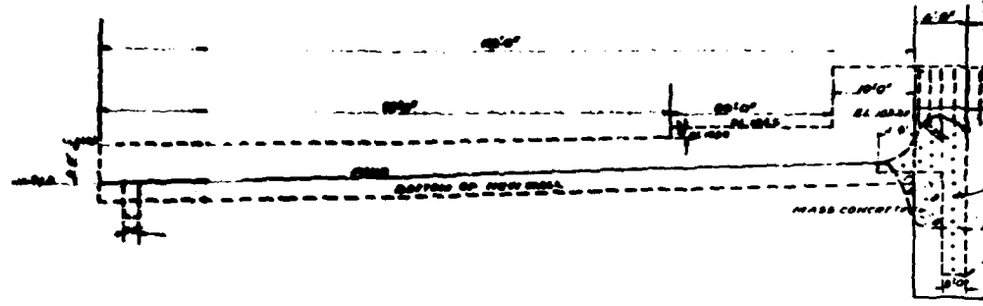
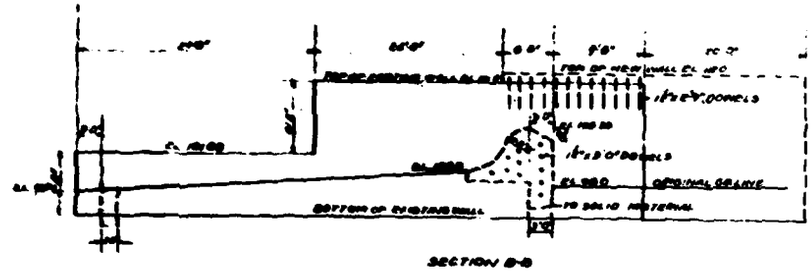
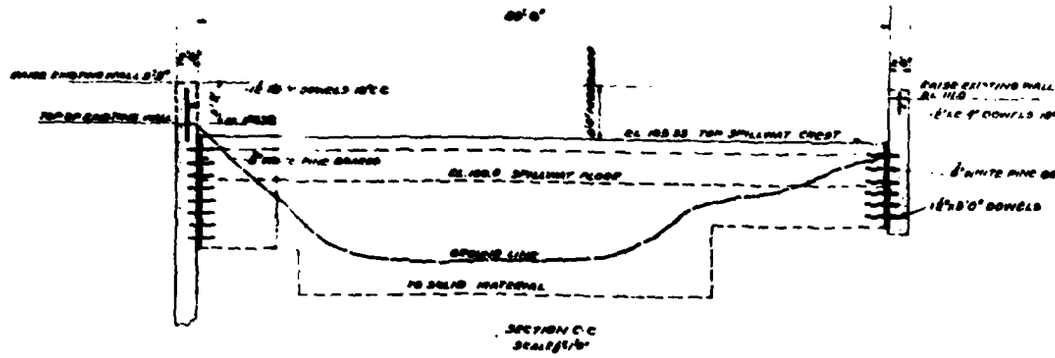


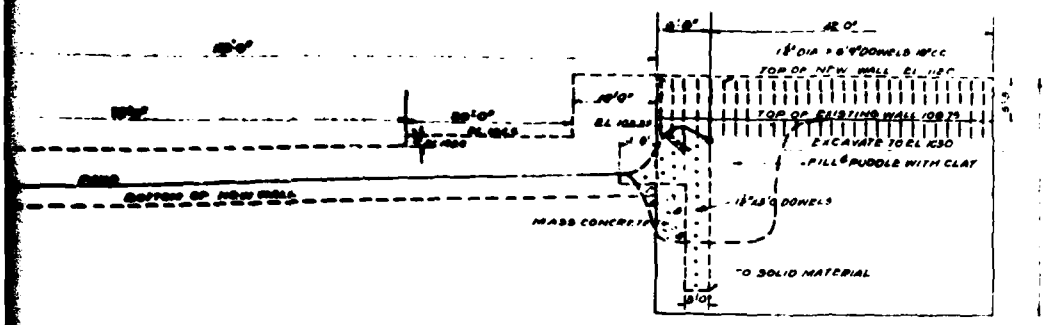
SECTION A-A



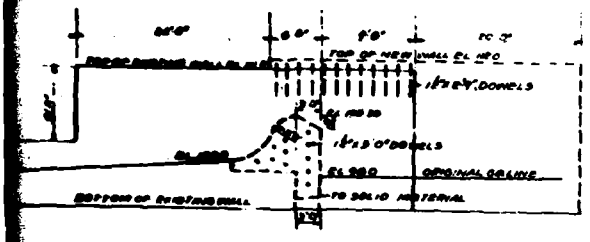
SECTION B-B



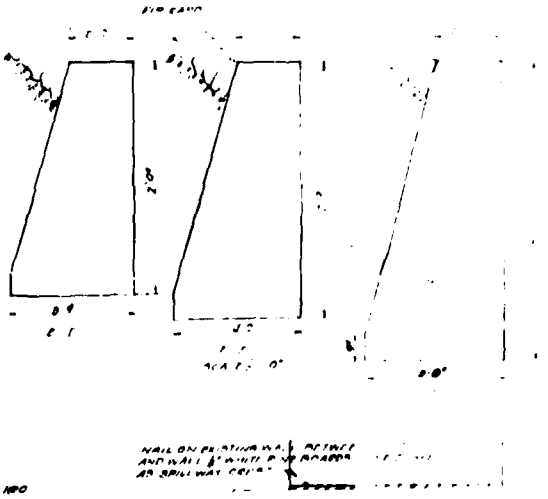
SECTION C-C

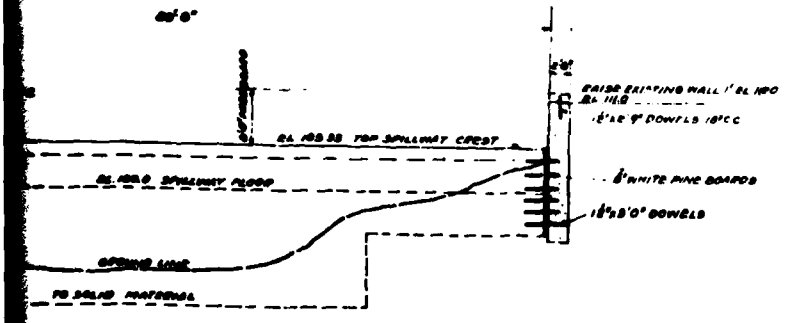


SECTION A-A



SECTION B-B

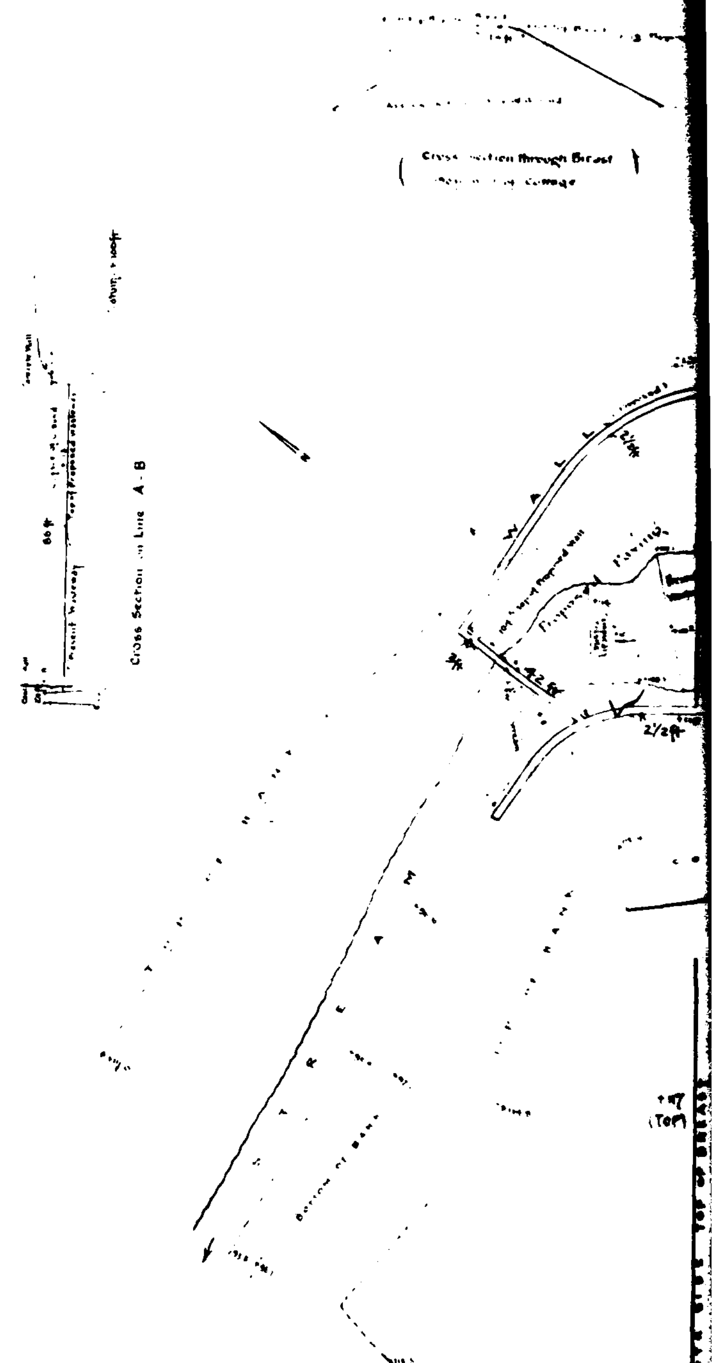




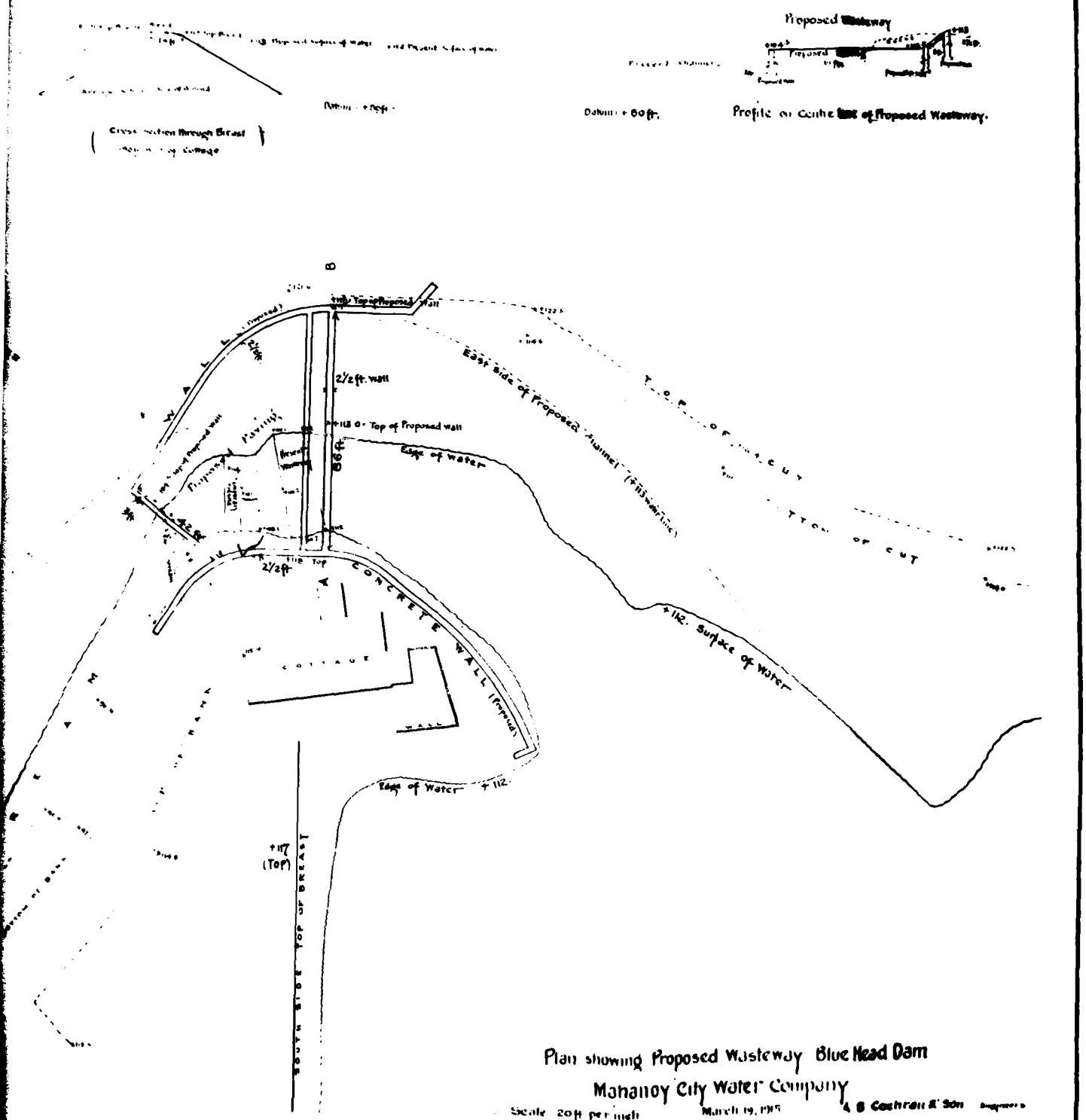
SECTION C-C

MA
SPIL

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



Cross Section on Line A - B
S T R E A M
2/2ft



Plan showing Proposed Wasteway Blue Head Dam

Mahanoy City Water Company

Scale 20ft per inch March 19, 1935 A S Cochran & Son Engineers

APPENDIX F
GEOLOGY

General Geology

The Blue Head Dam is located in the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. This area is characterized by tightly folded synclines and anticlines. The bedrock underlying the dam and reservoir is the Mississippian aged Mauch Chunck Formation. This formation contains primarily red shales and dark, fine-grained sandstones. The bedding is usually poorly developed. The irregularly spaced joints form a blocky or platy pattern, are fairly abundant and dip steeply. The formation is highly resistant to weathering and forms a good foundation for heavy structures. Some faulting is evidenced approximately three miles east of the reservoir and about four miles south of the reservoir.

GEOLOGIC MAP OF BLUEHEAD RESERVOIR AREA

MISSISSIPPIAN

Mmc — Mauch Chunk Formation

Scale 1: 250,000